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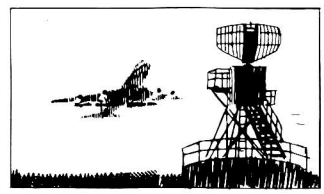

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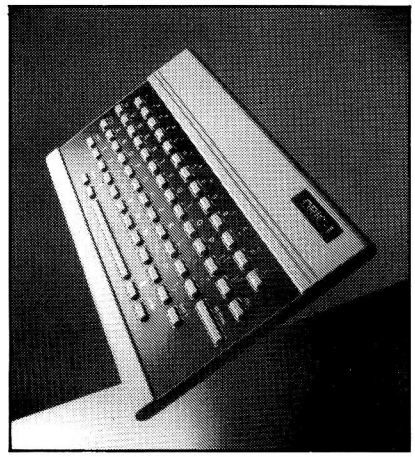

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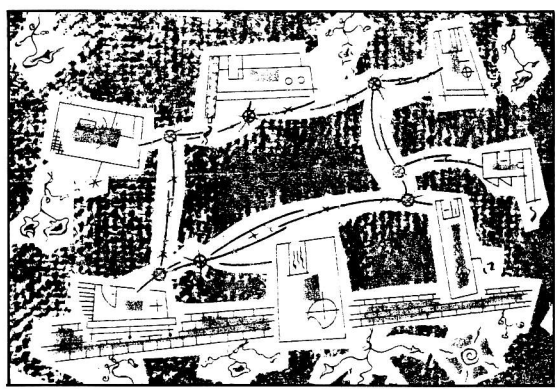

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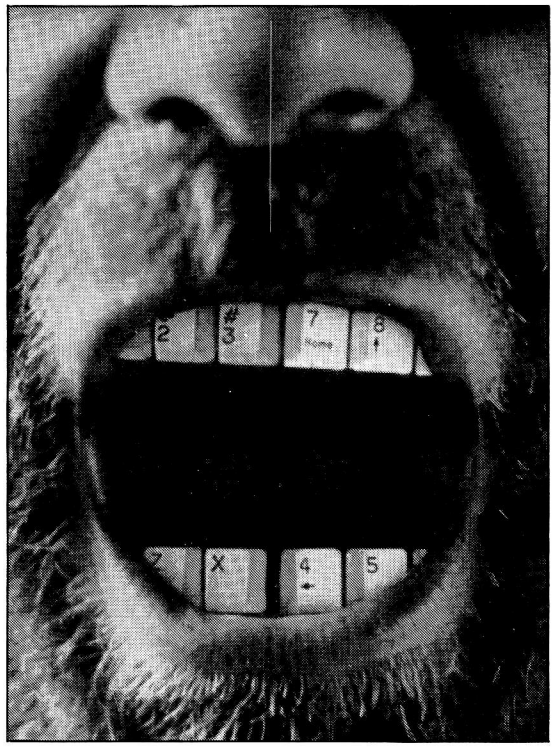

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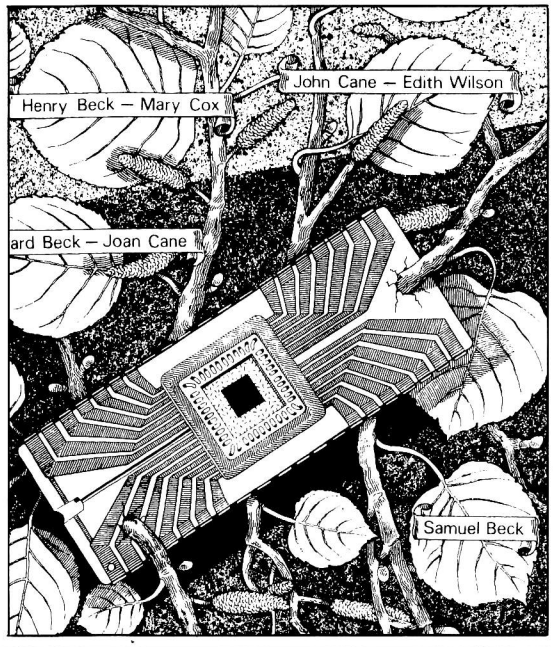

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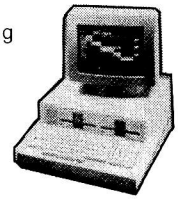

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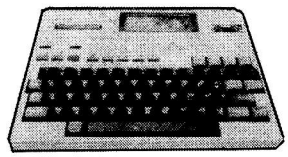

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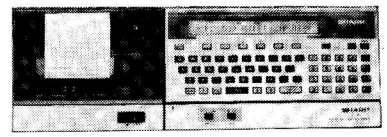

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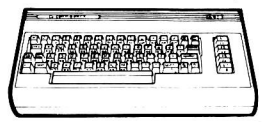

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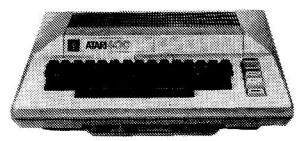

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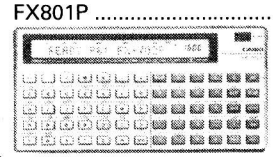

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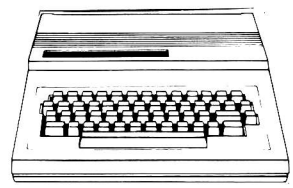

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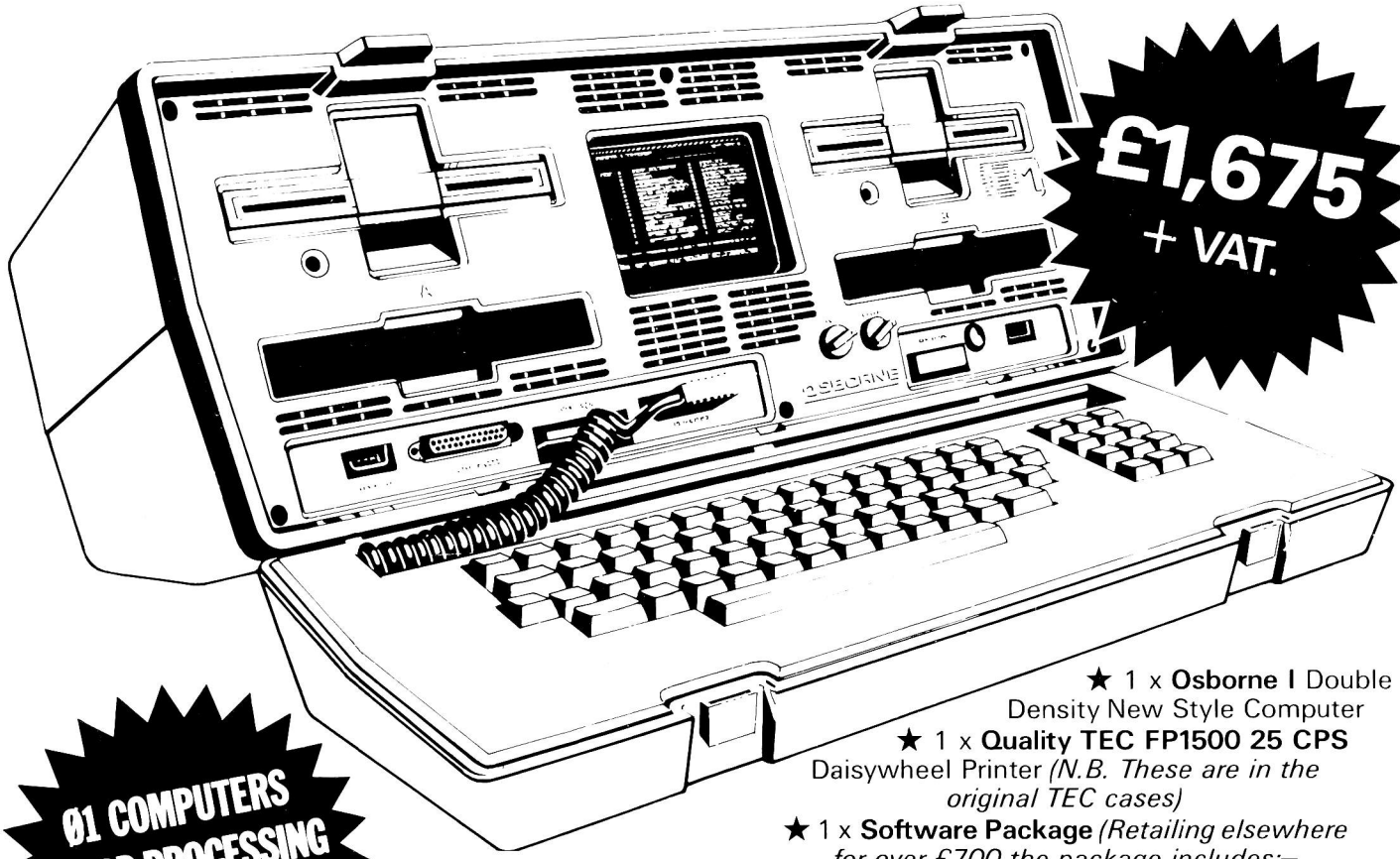

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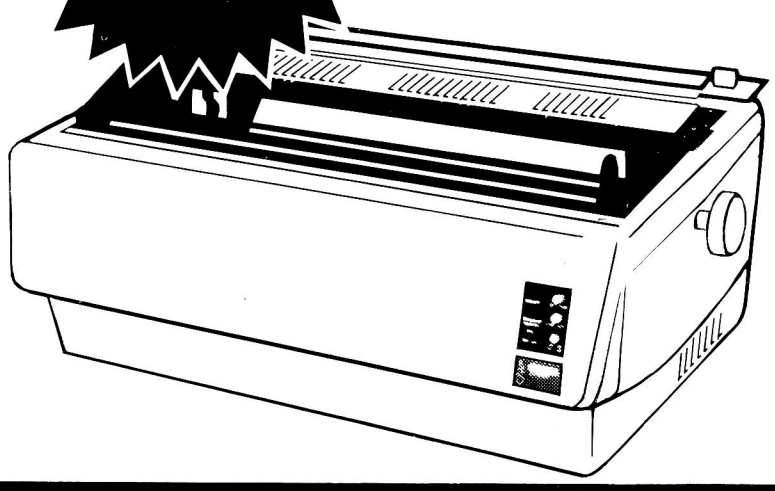

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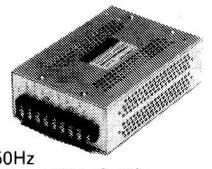

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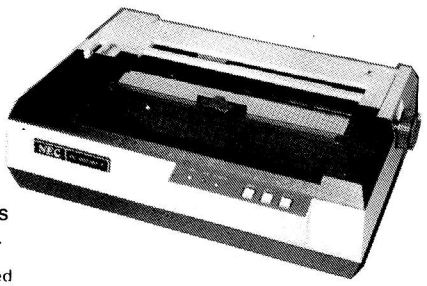

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Recommended for NEC 8023BE-C, EPSON and OKI Series of Printers

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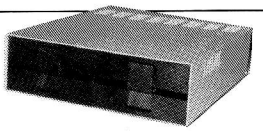

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Once again, ACT introduces a new price/performance breakthrough in personal computing: An ACT Sirius 1 16-bit personal computer with 128 Kbytes of RAM **COMPLETE** with integral 10 Mbyte Winchester for just £3995.

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Like all the Sirius range it's backed by the strength and resources of ACT: the PULSAR range of true 16-bit application software for accounting, planning and word processing; ACT Training Centres in London and Birmingham open to all; nationwide field service; a full range of printers and consumables. And, the most complete and professional dealer network in personal computing.

The new Sirius Winchester is the latest addition to the 16-bit ACT Sirius 1 family. Prices start at just £2395 for a dual floppy drive system with 1.2 Mbytes and £2895 for the double-sided floppy drive version offering 2.4 Mbytes. All provide an Intel 8088 16-bit processor and 128 Kbytes of RAM.

NEW SIRIUS WINCHESTER: THE FACTS

Winchester Subsystem

- 10.6 Mbyte (formatted) 5¼" integral Winchester drive
- 218 msec average access time
- Intelligent disk controller
- DMA interface to system memory
- Multiple operating systems
- User configurable

General Specifications

- 128 Kbytes RAM
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- 800 x 400 pixel high resolution graphics
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For more information on the new Sirius Winchester clip the coupon and return to

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SC1

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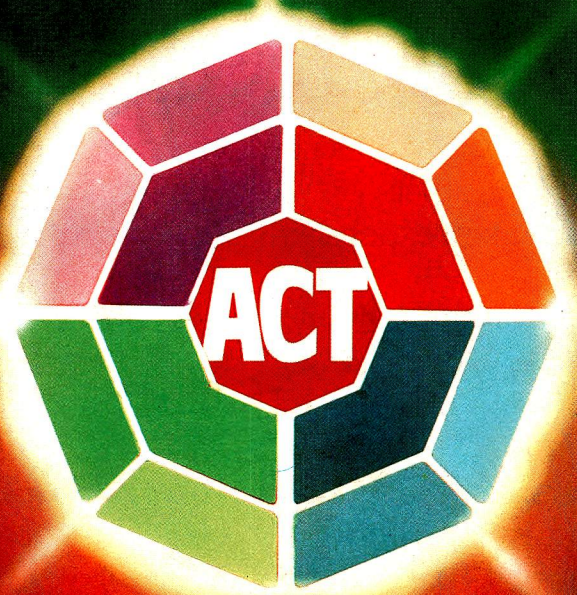
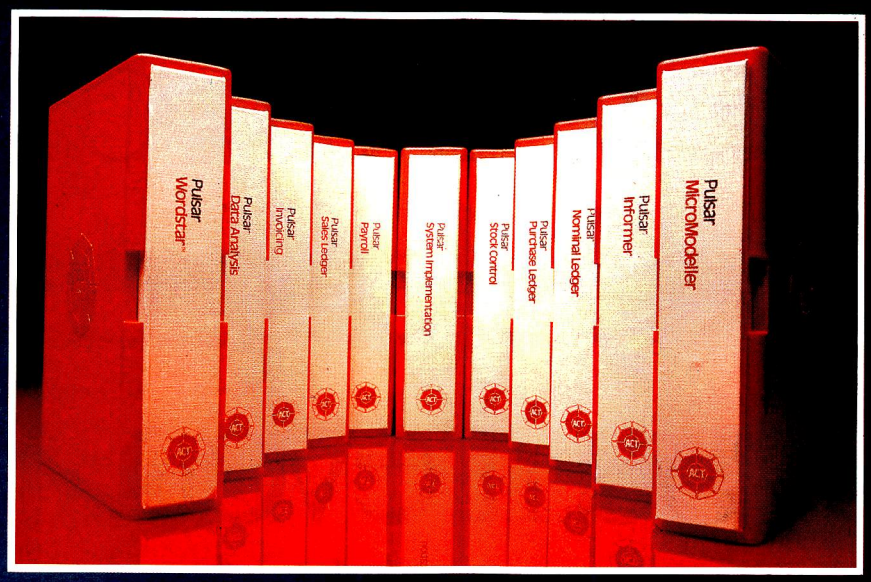


pulsar

16 BIT BUSINESS SOFTWARE



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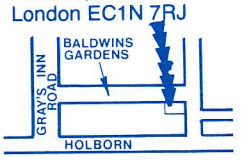

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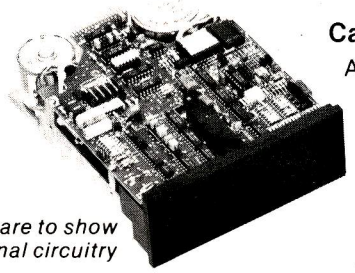

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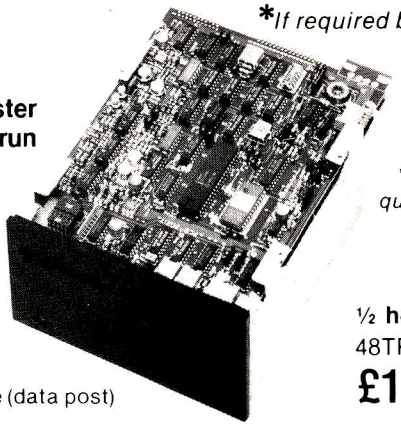

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74S175	260
74S188	140
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74S194	195
74S201	250
74S225	240
74S240	390
74S241	250
74S244	290
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74S288	210
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7402	11
7404	13
7410	14
7411	15
7413	18
7414	20
7420	15
7422	20
7427	18
7430	14
7442	32
7447	40
7448	40
7473	24
7474	20
7475	25
7485	60
7486	20
7489	170
7490	20
7491	35
7492	25
7493	25
74100	80
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74121	25
74125	35
74126	35
74143	210
74148	60
74150	50
74151	40
74153	40
74154	55
74186	470
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74383	99

74LS

LS00	11
LS02	11
LS04	12
LS08	12
LS10	12
LS11	12
LS13	15
LS14	26
LS19	58
LS20	13
LS22	12
LS27	12
LS32	13
LS40	12
LS42	28
LS47	35
LS48	55
LS63	120
LS73	18
LS74	18
LS75	20
LS85	42
LS86	16
LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
LS138	25
LS139	28
LS148	70
LS151	40
LS153	40
LS156	36
LS157	25
LS158	30
LS175	36
LS240	55
LS241	55
LS242	55
LS243	55
LS244	50
LS245	70
LS273	54
LS373	60
LS374	55
LS393	42
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4016	20
4017	32
4018	45
4023	13
4025	13
4027	20
4034	140
4040	40
4051	45
4052	60
4053	50
4066	24
4068	14
4069	13
4070	13
4076	50
4077	13
4078	15
4081	13
4093	20
4099	75
4160	95
4161	99
4162	99
4163	99
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4175	105
4411	690
4412	790
4419	350
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4451	350
4490	350
4500	675
4504	75
4505	185
4508	130
4511	45
4519	30
4528	50
4549	375
4569	175
4583	90
4584	40
4585	60
4597	330
4598	290
4599	290
40101	130
40105	105
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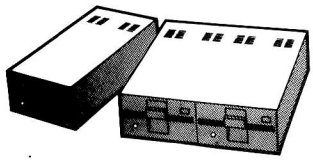

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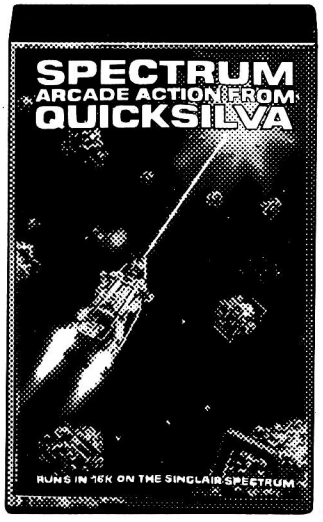

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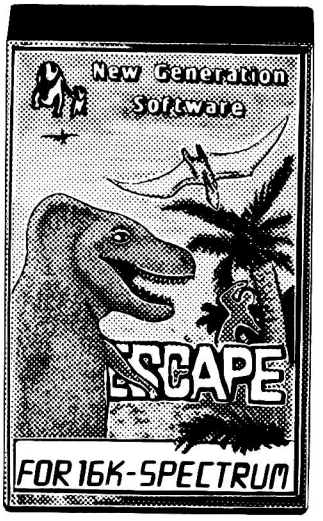

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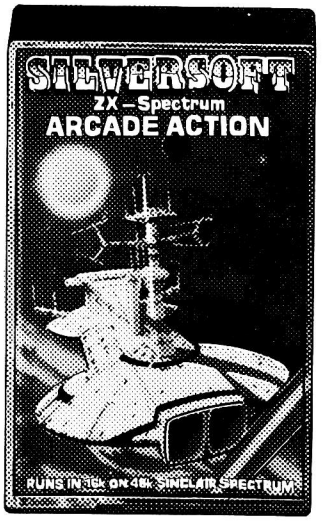

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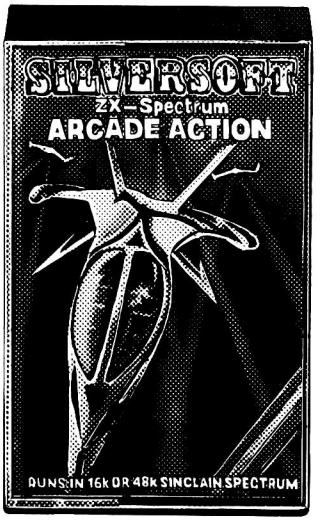

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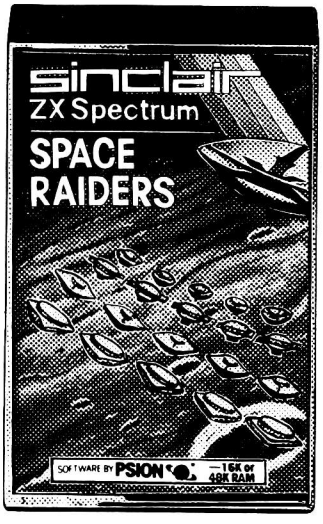

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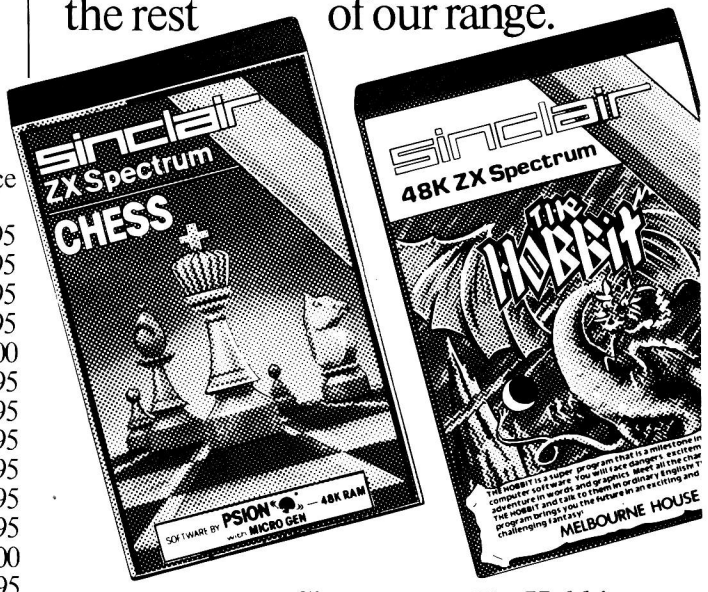

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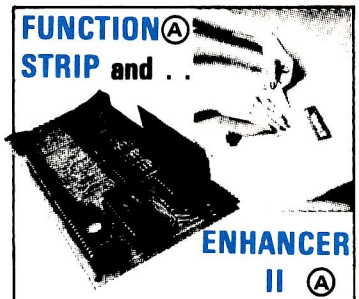

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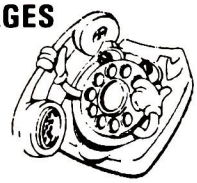

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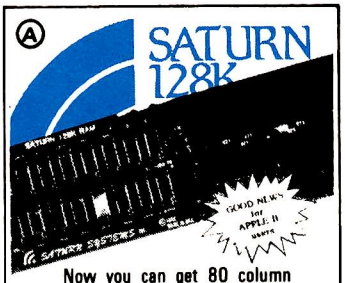

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VC Expand 80	£59.00
Videx Videoterm	£199.00
Soft 80 Column Switch	£21.95
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Videx Visicalc 80 Column Preboot Disk (no memory expansion)	£34.95

A new utility will be out soon enabling you to run Applesoft programs up to approx 160K in size.

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Sirius Proc & Monitor	£10.95
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BBC Computer	£8.95
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IBM PC Keyboard	£4.95
NEC 8023B-C Printer	£8.45
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Pet 4040/8050 Disc	£8.95
9060 Hard Disc	£8.95
Pet 4022P Printer	£5.95
Pet 8023P Printer	£7.45
Pet 8300P Printer	£9.45

HEAD CLEANING

Clean read/write heads the way leading manufacturers recommend 5¼" disc head cleaning kit. **£15.95**

DISCS & DISC BOXES

BASF single sided, single density discs 10 for **£17.90** 50 for **£84.50** 100 for £159

Kass-ette storage boxes **£1.95**

Ⓔ

IS Pipe Line

Random Access Printing Buffer

For the first time ever, here is a buffer that not only frees your fast computer from your slow printer but also allows you to rearrange, compose and copy your data on its way to the printer.

- Random Access Printing – stores paragraphs or pictures for printing in any order – any number of times.
- FIFO Printing – conventional first-in first-out operation.
- Compression of data for efficient utilisation of memory space.
- Ability to interrupt long-term buffer operations for straight-thru short-term printing.
- Simple Erase feature to clear buffer.
- Automatic duplication capability.
- Easily expandable, by you, from 8K Bytes to 128K Bytes.

The IS Pipe Line is Universal – it works with any parallel (Centronics – style) computer/printer combination. A special version is available for PKASO Printer Interfaces.

8K Buffer £189.00
128K Buffer £359.00

WESPER MICROSYSTEMS

WIZARD Peripheral Cards

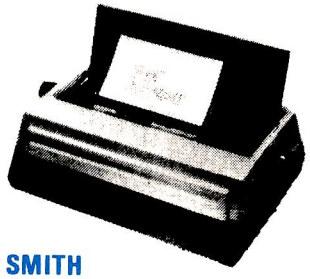
Ⓔ

WIZARD-EBI

64K Buffer for Epson Printers

With a WIZARD-EBI, you will never again have to wait for your printer to finish printing a job before you can start your next project. That's because the WIZARD-EBI allows you to use your computer on a new task during the time the printer is printing the previous one. The WIZARD-EBI can buffer 8K, 16K, 32K, or 64K characters depending on the number of RAM chips plugged into the board. The unit can be purchased with any buffer size and expanded later by simply plugging RAM chips into the empty sockets on the card.

£109



SMITH CORONA TP-I

Electronic Text Printer

- **LOW COST DAISY WHEEL PRINTER**
- **MICROPROCESSOR ELECTRONICS**
- **SERIAL OF PARALLEL INTERFACES**

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A/PC

ALPHA

The Apple-IBM Connection

Transfers any file back and forth!

CONNECT Apples to IBMs, Apples to Apples, or IBMs to IBMs. Transfer information from any file thousands of miles – in minutes.

£149

INDEX :

Ⓐ FOR APPLE COMPUTERS

BINED RANGE OF PRODUCTS
C/PM COMPUTERS IN THE UK!

Goods listed in this advertisement are available from our dealers throughout Europe

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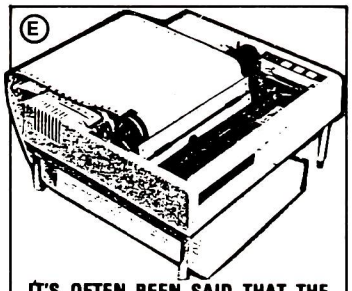

IT'S OFTEN BEEN SAID THAT THE SIMPLEST IDEAS ARE THE BEST – AND JUST LOOK AT THIS ONE FOR PAPER STORAGE.

stilts Pete & Pam Computer's Stilts are four legs which can be installed on to your Epson MX80 in seconds – giving you room for 3 inches of paper.

SPECIALLY REDUCED PRICE **£3.95**

---

d BASE II A/PC

The most powerful, easiest to use micro data base management system. Don't just take our word for it – read this review from "Info World". "Overall, I would rank dBASE II as excellent. It is fast, powerful and flexible, and it allows applications to be programmed far more quickly and easily than does BASIC or Pascal. It is hard for me to imagine any kind of small business application for which i would prefer one of the traditional languages over dBASE II."

You'll wonder how you managed without it.

d BASE II £399.00
Requires Microsoft Z-80 Softcard £239.00

dBASE II Utilities

dUTIL
The dBASE II Utility Program

dUTIL is Fox & Geller's utility program for dBASE II. dUTIL decreases the running time of dBASE II command files. dUTIL combines your command files automatically to produce a faster running time.

£89.00

QUICKCODE
The dBASE II Program Generator

Quickcode writes concise programs to set up and maintain any type of database. Run them as is, or customise them in seconds. You still have all the power of dBASE II and there is no programming required. All you have to do is draw your data entry form on the screen and you're in business.

£249.00

AUTOCODE 1

Autocode 1 – is extremely simple to use, a user with no programming experience and no knowledge of dBase II can produce programs within a hour or so of introduction to the system, since Autocode 1 – sets an automatic file maintenance and a standard reporting facility.

£120.00

dGRAPH
The dBASE II Graphics System

Now you can combine database and graphics. With dGRAPH by far the easiest to use graphics package in existence. Just press one key and you've got your graph.
And what graphs! Sales by month. Expense budget by division. This year versus last year. And each one can be a pie chart bar graph or line graph. It's up to you.
Advanced features make dGRAPH as powerful as it is easy. Features like autoGRAPH which will automatically load dBASE II data, compute scales, draw grid lines, and label charts. Then there's automatic shading and overlay graphs.
dGRAPH draws graphs on Epson, Okidata, and a growing list of other popular printers.

£249.00

ANNOUNCING...

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RING US TODAY– GET YOUR PRINTER TOMORROW!

We stock the following printers:

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OKI Microline 84 Parallel	£799
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Dealer prices available on request

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SEND NOW FOR OUR NEW CATALOGUE OF OVER 600 COMPUTER RELATED BOOKS

Our well equipped SERVICE & REPAIR DEPARTMENTS

IN ROSSENDALE & LONDON ARE NOW AVAILABLE FOR REPAIRS ON ANYONE'S APPLE OR IBM PC

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HARD DISK DRIVES

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THE PLUG – **cost effective computer care.**

A mains borne noise and transient suppression device incorporated within a modified 13 amp plug.

Helps cure unexplained software errors, and apparently intermittant hardware malfunctions.

£12.95

BIG NEWS

WE ARE PLEASED TO ANNOUNCE THAT OUR LONDON OFFICE IS NOW AN AUTHORISED IBM UK PERSONAL COMPUTER DEALER

LOOK AT THESE ITEMS FROM OUR WIDE RANGE OF PRODUCTS FOR THE IBM PC

80 Col Word Process IBM	
Write On for IBM PC	99.00
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Mailmerge For IBM	145.00
Superwriter For IBM (Oct 3/8)	249.00
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64K RAMcard for IBM PC	245.00
256K RAMcard for IBM PC	495.00
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Apparat 64K expandable RAMcard	119.00
16K upgrade for RAMcard	31.00
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Para/RS232/Clock Card For IBM	249.00
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Quadboard 192K,Clock & I/O	595.00
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Ⓔ FOR EPSON PRINTERS

P/C FOR THE IBM PC

spectrum

NEWS from SPECTRUM

ATARI 800

This **proven and tested** micro is now **UPGRADED to 48K RAM** and there's **no increase in price either** which must make it **about the best value around.** See our ad. for further details.

ATARI 400

Now **REDUCED** by a **MASSIVE £39** to an **incredible price of only £159.95** from **Spectrum.**

SINCLAIR ZX SPECTRUM

We have now added the super **SINCLAIR ZX SPECTRUM** 16K and 48K Models to our range – check our ad. for further details.

NEW SPECTRUM MEMBERS

Check our address page! – there are many new SPECTRUM dealers throughout the UK so there's a good chance there'll be a SPECTRUM centre very near you.

STOCKS

The general stock situation has now improved and you'll find that most **SPECTRUM** centres will be able to supply you **immediately** and at **super LOW prices too!**

INTRODUCING SPECTRUM FACTS!

Next to many of our offers, you'll find a few lines tagged SPECTRUM FACTS. We pride ourselves on providing **you,** the customer, with a **genuine service** as well as super LOW prices, and we want you to know that when you buy from a SPECTRUM dealer, you'll get **exactly the right Micro for your needs. SO LOOK OUT FOR YOUR SPECTRUM FACTS!**

After Sales care

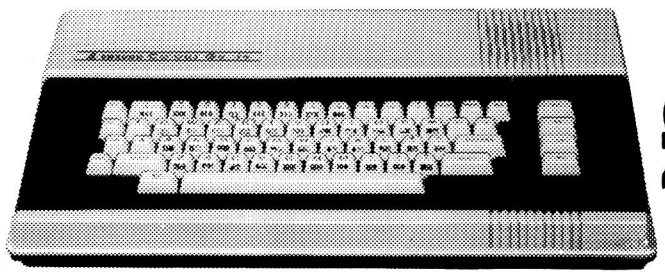
SPECTRUM service centres will ensure that should your machine 'go-down' **we will get it running again as quickly as possible.** We also offer **extended warranties** at reasonable prices too!– ask your **SPECTRUM HOME COMPUTER CENTRE** for full details.

COMPUTER DEALERS!

(or prospective Computer Dealers!) If you would like to know more about becoming a **SPECTRUM APPOINTED DEALER** on an **exclusive area basis,** please write to **MIKE STERN, Spectrum (U.K.) Ltd., Burrowfield, Welwyn Garden City, Herts.**

COLOUR GENIE

A truly reliable micro and highly recommended by Spectrum.



Spectrum **LOW** Price

£224.48 Inc.VAT

The new **COLOUR GENIE** features powerful and sophisticated **COLOUR GRAPHICS,** allowing you to create full 8-colour Games, Diagrams and Charts quickly and simply.

At its low **SPECTRUM** price, the Colour Genie is amazingly versatile – its **Powerful 16K RAM memory** (expandable internally to 32K) means **FULL COLOUR video games** and **POWERFUL COMPUTING** with a full range of inexpensive accessories: **16K RAM pack, Joysticks** for **TV games, Light Pen, Disk Drive** and a **Printer.**

But that's not all – the Colour Genie also features a **16K ROM Memory** with **128 Upper and Lower case Colour Graphics Characters** already stored, plus **sound,** a professional **typewriter keyboard.**

In use, it's as straightforward as any, thanks to the use of **BASIC** language and direct keyboard accessed **colour commands.**

The superb Colour Genie is at **SPECTRUM** now – check it out and see the Genius at work!

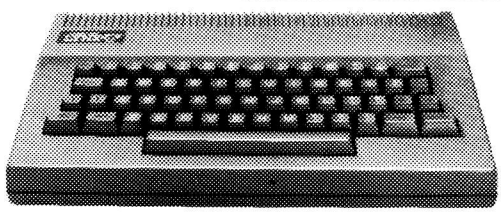
COLOUR GENIE ACCESSORIES

Joysticks	**£49.49**
16K RAM	**£38.50**
Printer Interface	**£39.95**
VISCOUNT Teach yourself Colour Genie BASIC	**£6.95**

SPECTRUM FACTS

Maximum user RAM	14,200 Bytes (approx)
Text Screen	24 x 40
High Resolution	160 x 96
Cassette Lead	Included

LYNX



Just look at this **super new LYNX Micro** – an **incredible** 16K+ 32K video ram and that's **expandable** up to or beyond **96K.** For just **£225.00 INCLUDING VAT** the **LYNX** is **exceptionally versatile.** All **LYNX's** 'add-on' connections are **standard types.** The **high definition colour graphics** make it a **top-value choice** for the **home or office** (with expansion, the **LYNX** can become an 80 characters-per-line word processor!) Take a look at the **LYNX** – a **memorable bargain** from **SPECTRUM.** But please phone to check stock position **before making a journey** as this new machine is bound to be in **great demand.**

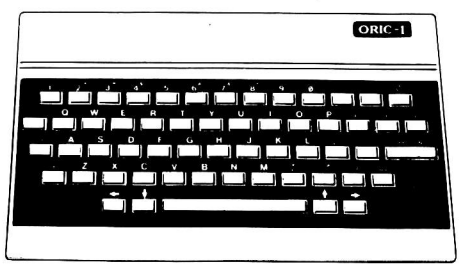
Spectrum **LOW** Price **£225.00**

VISCOUNT – Teach yourself LYNX BASIC £6.95

SPECTRUM FACTS

Maximum user RAM	13,700 Bytes (approx)
Text Screen	24 x 40
High Resolution	265 x 248
Cassette Lead	Included

ORIC-1

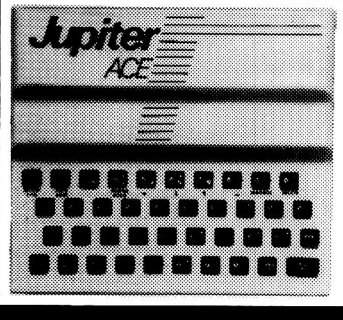


A superbly designed and engineered micro and great value-for-money from **SPECTRUM.** Offering **48K RAM Colour** – (8 foreground and 8 background can be displayed at same time) **High resolution graphics User definable Graphics. Full sound** (6 octaves of controllable sound.) **Easy to use keyboard** with **moving keys. Standard Centronics parallel interface allows** easy connection to a wide range range of printers etc.

Spectrum **LOW** Price **£169.95** Inc. VAT

SPECTRUM FACTS

Maximum user RAM	47,870 Bytes
Text Screen	28 x 40
High Resolution	240 x 200
Cassette Lead	Included



JUPITER ACE

Outstanding value-for-money! The **JUPITER ACE** uses easy to understand **FORTH** language. **Connects to your own TV. 3K RAM expandable to 19K. Full moving keyboard** with auto repeat and caps lock. **Full sound and chunky graphics.** If you've wanted to learn an impressive Language then this is the machine for you.

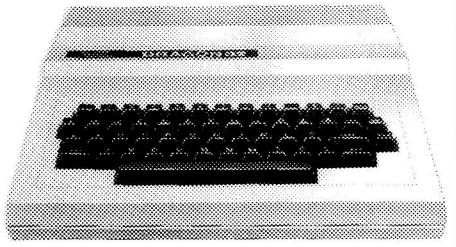
Spectrum **LOW price** **£89.95** Inc VAT **£76.22** ex vat

SPECTRUM FACTS
Maximum user RAM 1,000 Bytes approx.

Not all stores carry every advertised item, please phone before making a journey – Prices correct at time of going to press E. & O.E.

HURRY! Limited stocks only-

DRAGON



Unbelievable value at only £199.95 from **SPECTRUM**! British built and designed it's one of the **most impressive micros** to appear for quite some time. Extensive facilities include highly advanced colour graphics. Just look at this top specification: Powerful standard 32K RAM (expandable to 64K Bytes). ■ 9 Colour, 5 resolution Display. ■ Extended Microsoft colour BASIC (as standard). ■ Advanced sound with 5 octaves – 255 tones. ■ Professional style editing, e.g. extract line, auto find reinsert. ■ Professional quality keyboard. ■ Centronics Parallel printer interface. ■ Serious programmer/user – the BASIC on this machine is similar to that found on machines costing 3 times the price! ■ Uses almost any cassette recorder. ■ Standard file handling ON TAPE.

Spectrum LOW price £199.95 INC. VAT

SPECTRUM FACTS

Maximum user RAM	29,679 Bytes
Text Screen	16 x 32
High Resolution	256 x 192
Cassette Lead	Included

	EX VAT	INC VAT
ACCESSORIES		
Joysticks (pair)	£17.35	**£19.95**
Cassette Lead	£2.35	**£2.70**
CARTRIDGES		
Beserk	£17.35	**£19.95**
Cosmic Invaders	£17.35	**£19.95**
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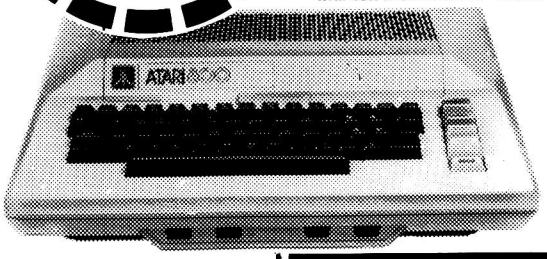
Black Sanctum	£6.91	**£7.95**

VISCOUNT Software for DRAGON
Teach yourself Dragon Basic . . £6.95

Now with **48K RAM** and still at the same LOW price!

ATARI 800

Now this proven and tested machine has been upgraded to a massive **48K RAM** and it's still at the amazing **LOW** price of **£399.99** from **SPECTRUM**. It's an ideal Home Micro for graphics, educational and personal finance etc, use and it will take you from learning up to small business use. You can add printers, program recorders, disk drives and more, to expand your micro as and when you want, to suit your needs. So if you're looking for a top-of-the-line micro you must see the **ATARI 800** with **48K** at **SPECTRUM – NOW!**



Spectrum LOW Price

£399.99 INC. V.A.T.

SPECTRUM FACTS

Maximum user RAM	37,899 Bytes
Text Screen	24 × 40
High Resolution	320 × 192
Cassette Lead	Needs own Recorder

ATARI 400

16K RAM

NOW ONLY £159.95 INC. VAT

BASIC cartridge extra

£39.99 inc. VAT

(£34.77 ex. VAT)

SPECTRUM FACTS

Maximum user RAM (with basic Cartridge)	13,323 Bytes
Text Screen	24 × 40
High Resolution	320 × 192
Cassette Lead	Needs own Recorder

ATARI DISK DRIVE
£299.00 INC. VAT

ACCESSORIES, BOOK & GAMES for ATARI

	INC VAT
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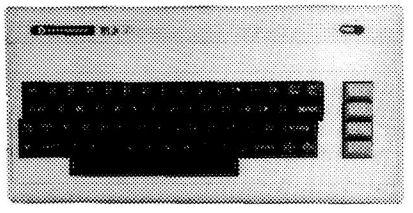
Programmer Kit (Basic Cartridge & Manuals)	£39.99

Commodore VIC-20



Now a top quality home/business micro for the price of a games machine.
■ Memory expandable to 32K ■ High resolution (full PET type) graphics ■ 16 Screen colours and 8 border colours ■ Plugs in to your TV, or monitor ■ Add Disk Drive & Printer for impressive 170K Byte system ■ Can act as an intelligent terminal for a larger computer.

£129.90 INCLUDING VAT

SPECTRUM FACTS

Maximum user RAM	3,853
Text Screen	22 x 23
High Resolution	176 x 158
Cassette Lead	Needs own Recorder

COMMODORE 64

Very limited supplies of this new micro now available – please check with your local SPECTRUM dealer before making a journey.

Spectrum LOW Price £345.00

VISCOUNT SUPER X2
64K DYNAMIC RAM PACK for VIC-20
EXCLUSIVE TO SPECTRUM!

Unbelievable-but-true, now you can up grade your VIC-20 from 3.5K to a massive 67½ RAM. Enables you to load up to 8 games or programs at a time & still select which one you wish to use. Can be used in conjunction with other expansions to increase total memory up to 152K-using the VIC memory expansion board. The SUPER X-2 will make your VIC-20 the biggest little micro in town!

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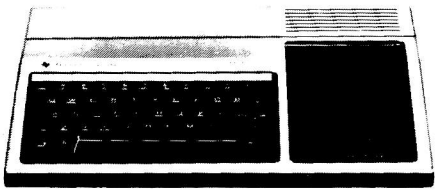

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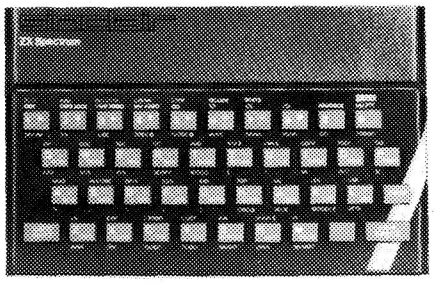

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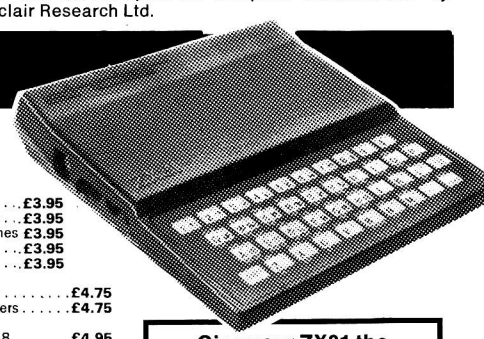

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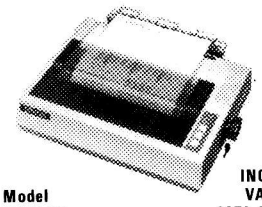

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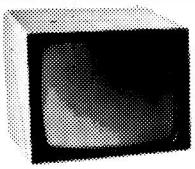

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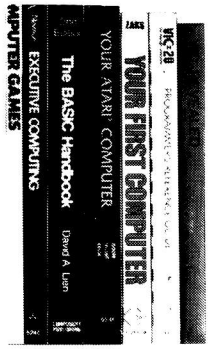

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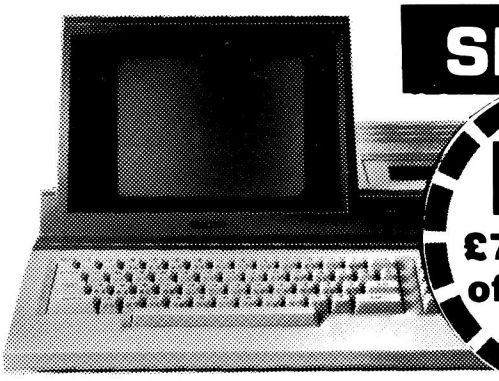

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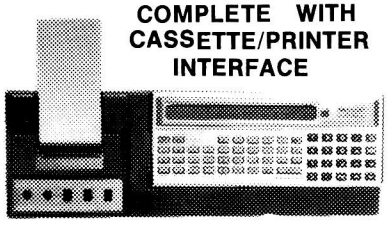

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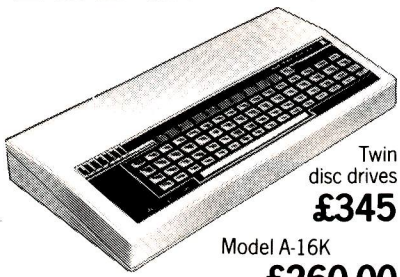

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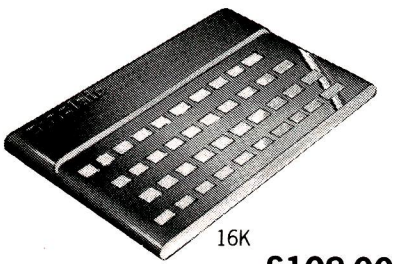

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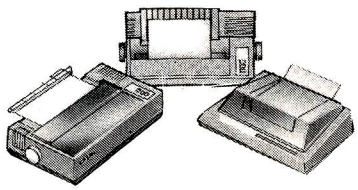

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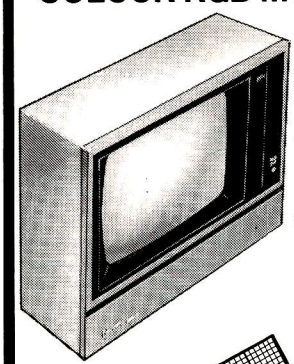

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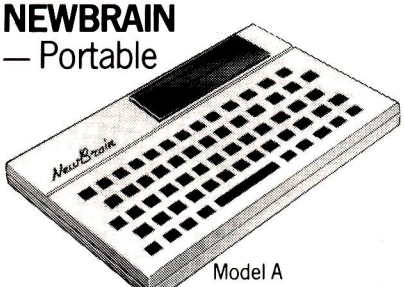

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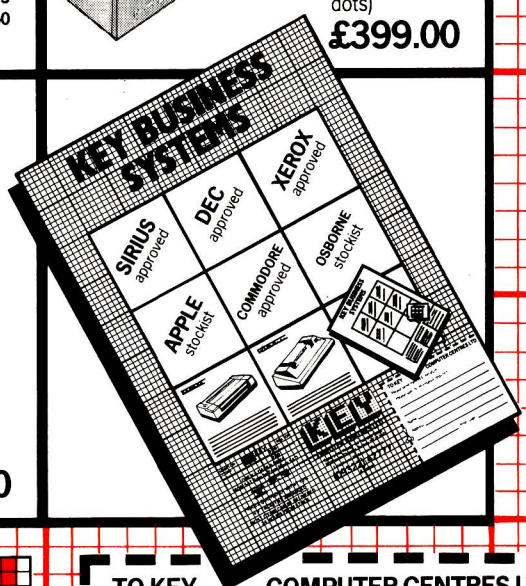

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* summary of VAT information to enable you to complete your VAT returns
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* Print the tabulated results in an elegant report format.
* Experienced users may access saved files and write their own reporting or graphics presentation programs for the results.

Some typical applications:–

* Small business accounting applications, e.g. profit and loss statements and cashflow projections, break-even analyses etc.
* Investment project appraisal – anything from double glazing to oil rigs!
* Comparing rent/lease/buy options
* Processing the results of scientific experiments or field studies
* Engineering calculation models
* In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:–

	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts
Sinclair Spectrum 16k or 48k	●	●	●					●	●
Dragon 32k or 64k	●				●			●	
VIC20 (16k+)	●	●	●	●				●	●
Sinclair ZX81 (16k+)	●								
Grundy Newbrain	●								
Texas TI99 4A	●								
Osborne 1	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

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ır business at petty cash prices.

INVOICES AND STATEMENTS . . . £19.95

Compatible with most micros. See table. Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations include VAT automatically, and the program allows your own messages on the form produced. This program gives you superb presentation and saves time on one of the most tedious tasks in the office.

COMMERCIAL ACCOUNTS . . . £19.95

Compatible with most micros. See table. A gem of a program, all for cassette, with the following features:– Daily Journal. Credit Sales. Cash Sales. Credit Purchases. Purchases – other. Sales Ledger. Purchase Ledger. Bank Account. Year to date summary. A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance.

MAILING LIST . . . £19.95

Compatible with most micros. See table. A superb dedicated database to allow for manipulations of names and addresses and other data. Gemini's unique 'searchkey' system gives you a further ten 'user-defined parameters' to make your own selections. Features include the facility to find a name or detail when only part of the detail is known, it will print labels in a variety of user specified formats.

DATABASE . . . £19.95

Compatible with most micros. See table. The program that everyone needs, the most valuable and versatile in your collection. Facilities include sort search, list print if required. Can be used in place of any card index application; once purchased you can write your own dedicated database to suit your particular needs with a limitless number of entries on separate cassettes.

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Compatible with most micros. See table. Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account mortgage, H.P. etc. This program also allows you to plot graphically by Listograms your monthly outgoings.

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Tractor feed unit simple clip-on device with standard tractors which are variable for most continuous paper widths. Requires no workshop modifications.

OCTET-EI

- IEEE to RS232 converter for PET microcomputer.
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- RS232 plug-in PCB.
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- Stand alone table top unit.
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OCTET-PR

As OCTET-PO but facilitates punching and reading of telex tapes.

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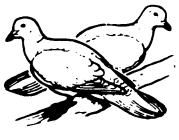
Full details from sole suppliers: **Duplex Communications Ltd and Duplex Communications (South) Ltd**



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*The OCTET-KSR and MSR typewriter interfaces are sold exclusively by BRITISH OLIVETTI and their distributors. Please contact your local agent for further details.

TELEWRITER™
the DRAGON 32 Word Processor

TELEWRITER

Telewriter is the powerful word processor designed specifically for the DRAGON 32 Computer. It can handle almost any serious writing job and is extremely easy to use. It has all the advanced features you need to create, edit, store, format and print any kind of text. With Telewriter you can quickly produce perfect, finished copy for letters, reports, term papers, articles, technical documentation, stories, novels, screenplays, newsletters. It is also a flexible and efficient way to take notes or organize ideas and plans.

51 × 24 DISPLAY

The DRAGON 32 is an incredibly powerful and versatile computer, but for text editing it has some major drawbacks. The small 32 character by 16 line screen format shows you too little of the text and, combined with its lack of lower case letters, bears little resemblance to the way text really looks on the page. Reverse video in place of lower case just adds confusion.

Telewriter eliminates these shortcomings with **no hardware modifications required.** By using software alone, Telewriter creates a new character set that has **real lower case letters,** and puts 24 lines of 51 characters on the screen. That's more on-screen characters than Apple II, Atari or TRS-80 Model III. That's more than double the DRAGON 32's standard display.

FULL SCREEN EDITOR

The Telewriter editor is designed for maximum ease of use. The commands are single key (or single key plus control key), fast, and easy to remember. There is no need to switch between insert modes and delete modes and cursor movement modes. You simply type. What you type is inserted into the text at the cursor, on the screen. What you see on the screen is always the current state of your text. You can move quickly through the text with one key cursor movement in all 4 directions, or press the shift key simultaneously for fast, auto-repeat. You can jump to the top or bottom of the text, and beginning or end of a line, move forward or backward a page at a time, or scroll quickly up or down. When you type past the end of the line, the wordwrap feature moves you cleanly to the next.

You can copy, move or delete any size block of text, search repeatedly for any pattern of characters, then instantly delete it or replace it with another. Telewriter gives you a tab key, tells you how much space you have left in memory, and warns you when the buffer is full.

. . . truly a state of the art word processor . . . outstanding in every respect
– The RAINBOW, Jan. 1982

The only one with all these features for your DRAGON 32

51 column × 24 line screen display
Sophisticated full-screen editor
Real lower case characters
Powerful text formatter
Works with any printer
Special MX-80 driver
Requires absolutely no hardware modifications
★ Tandy colour version also available

FORMAT FEATURES

When it comes time to print out the finished manuscript, Telewriter lets you specify: left, right, top, and bottom margins, line spacing and lines per page. These parameters can be set before printing or they can be dynamically modified during printing with simple format codes in text.

Telewriter will automatically number A4 pages (if you want) and centre lines. It can chain print any number of text files from cassette without user intervention. You can tell it to start a new page anywhere in the text or pause at the bottom of the page.

You can print all or any part of the text buffer, abort the printing at any point, and there is a "Typewriter" feature which allows you to type straight to your printer. Because Telewriter lets you output numeric control codes directly (either from the menu or during printing), it works with any printer (Tandy, Seikosha, MX-80, Okidata, NEC 8023, C. Itoh 8510, Centronics, GE Terminet, Smith Corona TP-1, etc.). There's even a special driver for the Epson MX-80 that lets you simply select any of its 12 fonts and do underlining with a single underline character.

CASSETTE INPUT/OUTPUT

Because the Telewriter makes using cassette almost painless, you can still have a powerful word processor without the major additional cost of a disk. The advanced cassette handler will search in the forward direction till it finds the first valid file, so there's no need to keep retyping a load command when you are lost in your tape. The Verify command checks your cassette save to make sure they're good. You can save all or any part of the text buffer to cassette and you can append pre-existing files from those you have in the buffer already.

ASCII COMPATIBLE

Telewriter turns your DRAGON 32 into the most powerful, lowest cost, word processor in the world today. But that's not all. The simple ASCII conversion program provided with Telewriter means you can use the full power of the Telewriter editor for creating and editing BASIC and assembly language programs. It means you can use Telewriter to prepare or edit text files used with any data communications program.

Telewriter costs £49.95 on cassette and is

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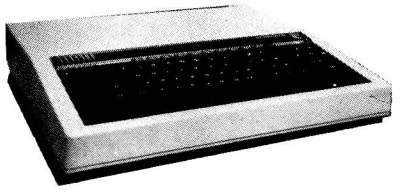

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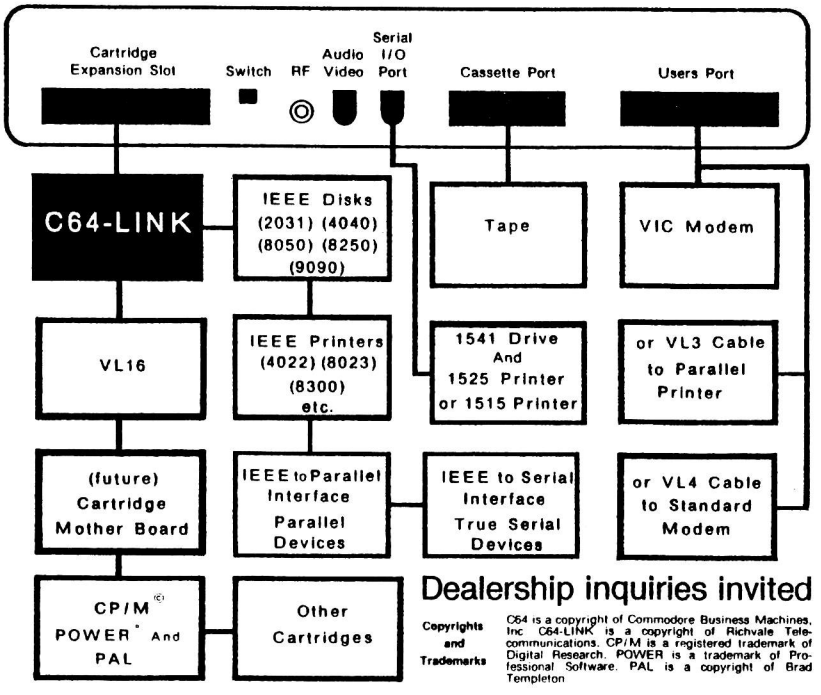

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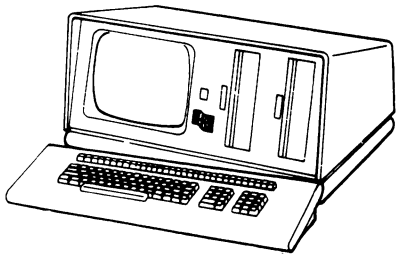

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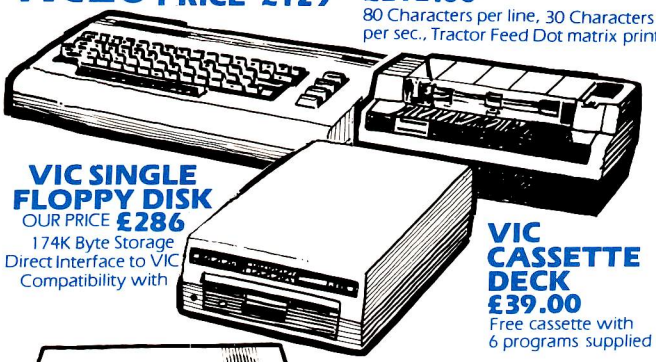

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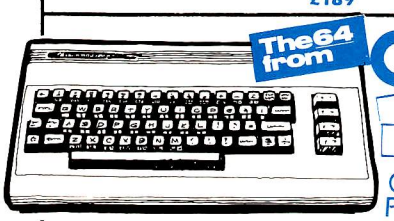

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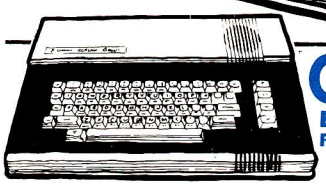

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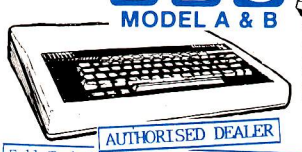

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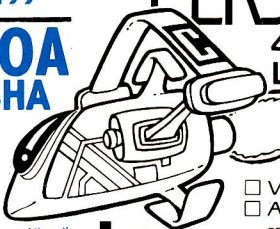

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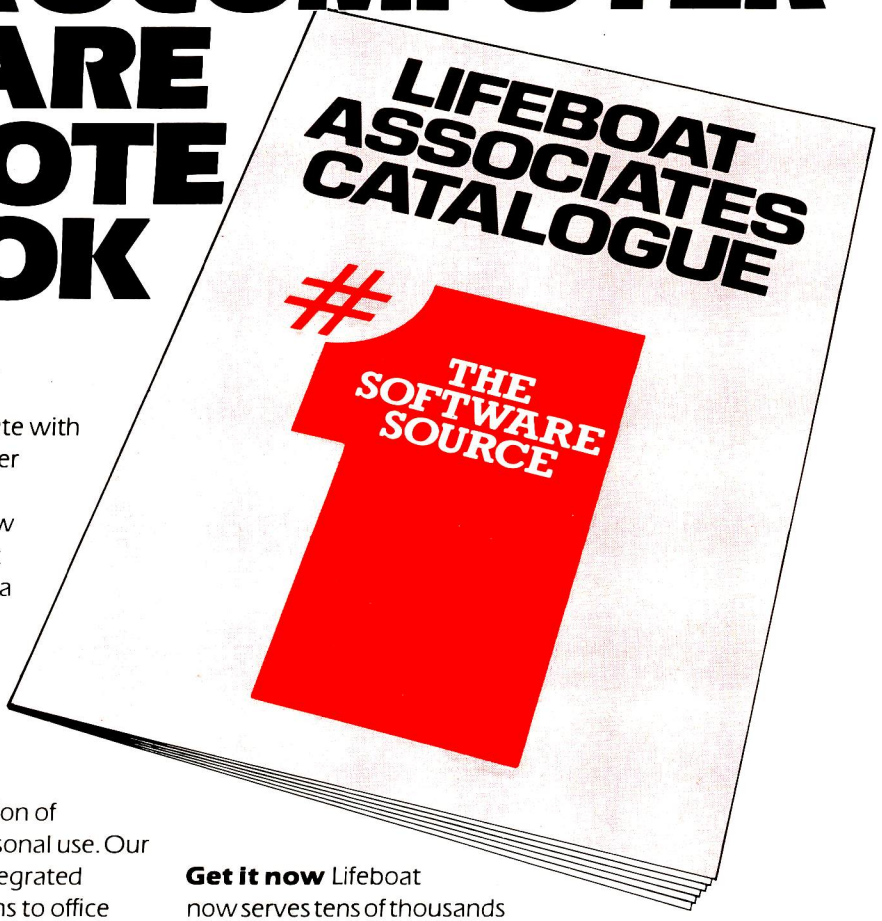

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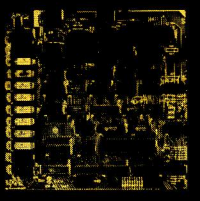

- ★ 4 MHz Z80A CPU
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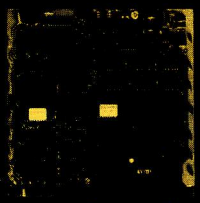

- ★ 80x25 Display Format
- ★ On-board Z80A Microprocessor
- ★ Buffered Keyboard Input
- ★ Programmable Character Generator
- ★ 160x75 Pixel Graphics
- ★ Light Pen Input

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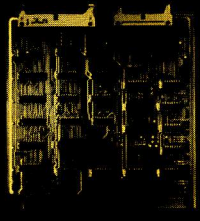

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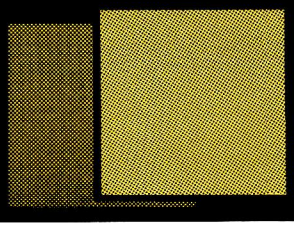

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It has a CP/M operating system which gives access to the largest range of software available for any machine. In particular, Gemini can offer QUIBS; a small-business package developed especially for the Galaxy.

The Galaxy has industry-standard interfaces (parallel and serial), and Gemini Microcomputers can supply a full range of compatible hardware including a Winchester sub-system and printer.

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1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q ≤ PLOT ASN
W <> DRAW ACS
E >= REM ATN
R < RUN VERIFY
T > RAND MERGE
Y AND RETURN [
U OR IF]
I AT INPUT IN
O ; POKE OUT
P " PRINT ©
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW ~
S NOT SAVE |
D STEP DIM \
F TO FOR {
G THEN GOTO }
H ↑ GOSUB CIRCLE
J − LOAD VAL $
K + LIST SCREEN $
L = LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z : COPY BEEP
X £ CLEAR INK
C ? CONT PAPER
V / CLS FLASH
B * BORDER BRIGHT
N , NEXT OVER
M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

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16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

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First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

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Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

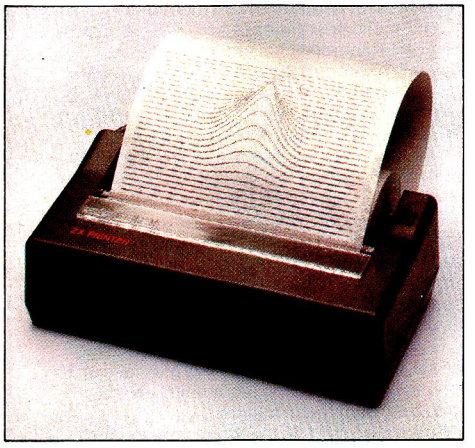
The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.



How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

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Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
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Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive-or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, −, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY. ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair

ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

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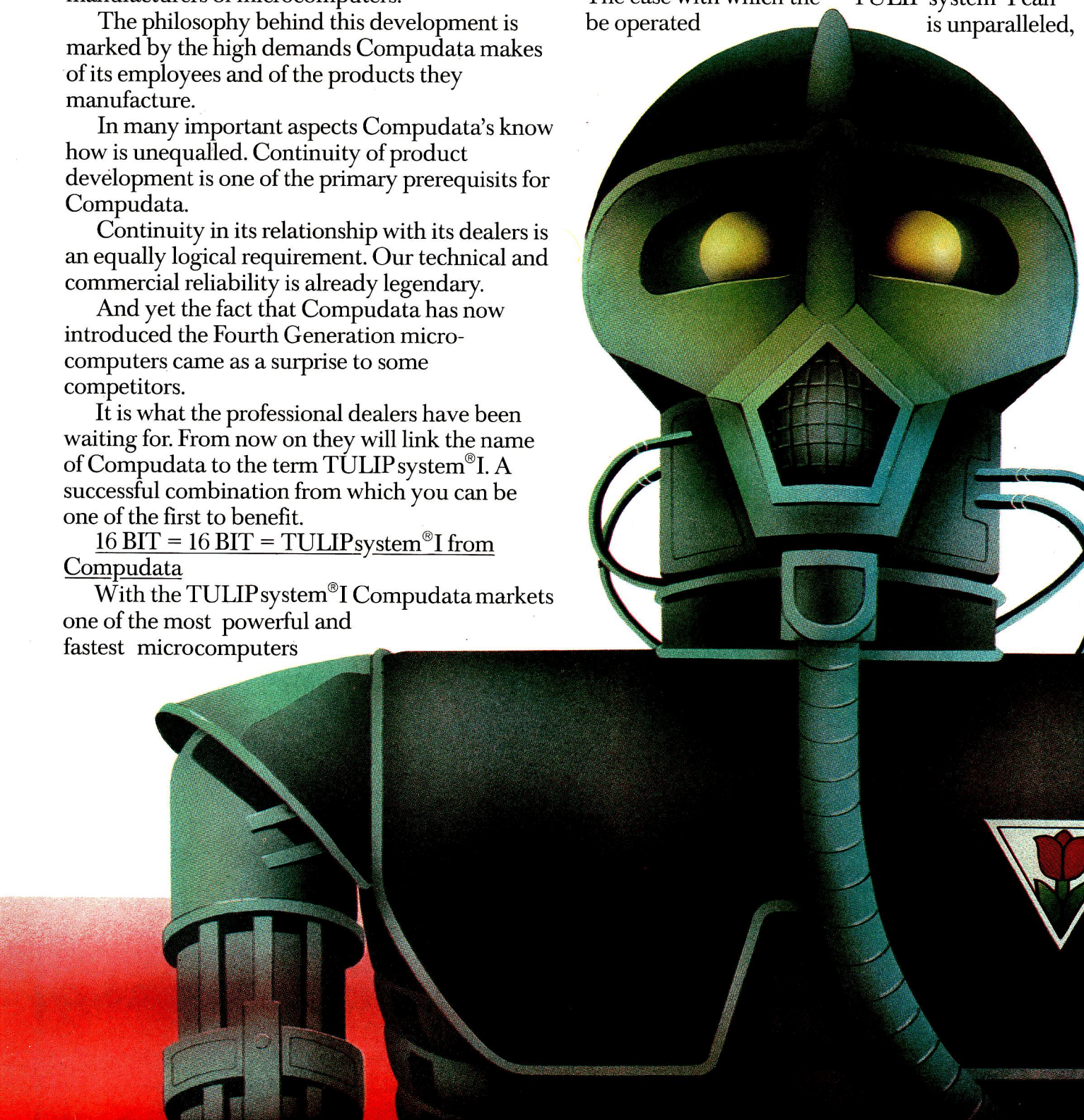

the Fourth Generation

partly due to the vast keyboard with its 104 keys.

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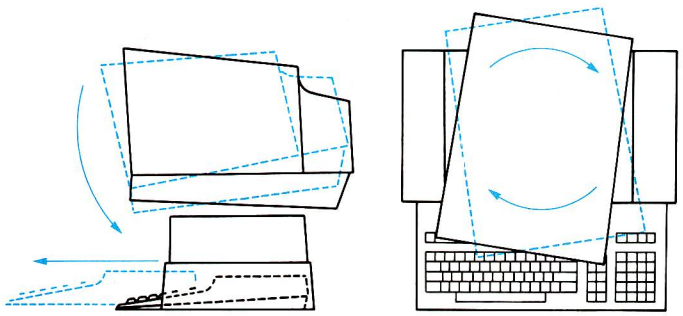

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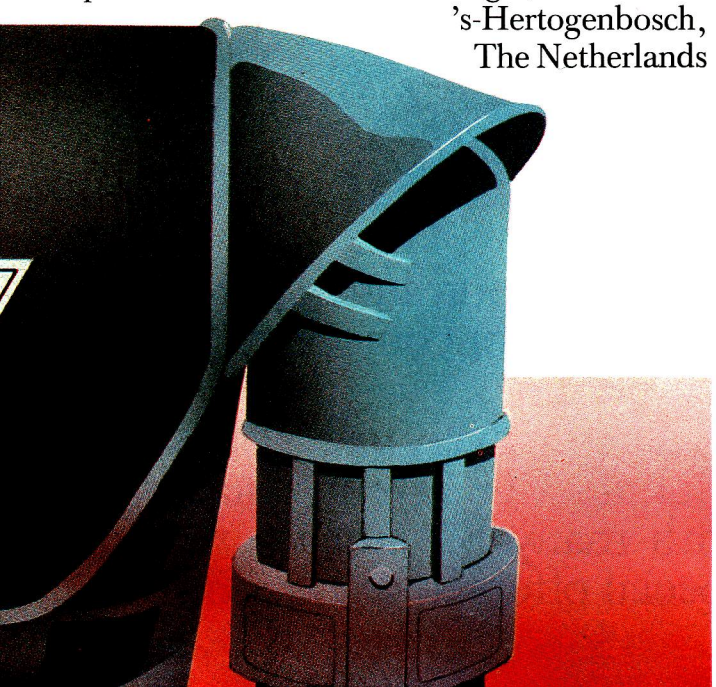

Compudata has pushed open the door invitingly to the Fourth Generation. The professional dealer knows what that means.

Profile of the Fourth Generation: TULIP system®I

Specifications

Computer.	
Processor	8086, 8087 (opt)
Clock	8 Mhz
RAM	128-896 Kb
Serial I/o	RS-232
Parallel I/o	Centronics comp.
Interfaces	Hard-disk, tape, lightpen
Fl. disk controller	8 inch + 5¼ inch
Bufferd Keyboard	104 keys

Storage.	
Floppy disk	dual 5¼ inch; 1.5 Mb
Hard disk – fixed	5 MB, 10 Mb
– removable	5 Mb
Display.	
Formats	80 x 25, 64 x 31, 40 x 25
Low res. graphics	100 x 160
High res. graphics	786 x 288 (opt)
Colour	8
Internat. char. sets	8 – softw. selectable

Please send me details of the dealership for TULIP system®I as soon as possible.

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Name:.....

Function:.....

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The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

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And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

Listed here is a sample of some of the more popular cartridges and cassettes available from Dragon's vast range of software.

GHOST ATTACK	Cartridge. An exciting maze game for one or two players.
PERSONAL FINANCE	Cassette. Keep track of family finances, create address lists and directories.
METEROIDS	Cartridge. Guide your ship through the treacherous asteroid belt. Requires skill, fast reactions and concentration.
CHESS	Cartridge. With 9 levels this is nearly impossible to beat.
CALIXTO ISLAND	Cassette. Avoid the eerie goings-on and escape from this evil island.
ASTROBLAST	Cartridge. Shoot the enemy spacecraft before they get you. (Action packed.)
COMPUTA VOICE	Cassette. Make your Dragon speak. Using phonetic sounds, even regional accents can be produced.
TYPING TUTOR	Cassette. Teach yourself to type accurately. Improve your speed and accuracy.
BERSERK	Cartridge. A challenging shooting game based on the popular arcade game.
GRAPHIC ANIMATOR	Cassette. Create simple cartoons on the screen, then animate them.
COSMIC INVADERS	Cartridge. Dragon version of famous arcade game. 15 levels of difficulty.
MADNESS AND THE MINOTAUR	Cassette. A real-time adult strategy game, descend into the labyrinth of King Minos in search of treasure.

BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

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But don't let the size fool you. The HX-20 is not a gimmicky toy or an excuse for a calculator. It's a precision machine using a full extended version of Microsoft BASIC with 16k RAM, optionally expandable to 32k and 32k ROM expandable to 64k, RS-232C and Serial interfaces. The ASCII typewriter keyboard and five programmable keys brings ten separate program functions to your fingertips.

Power to your elbow.

The HX-20 runs on its own power supply for over 50 hours and can be easily recharged overnight, or whilst in use, with the ability to retain its memory in RAM even when switched off.

Keeping you in the picture.

The LCD screen is unique – showing any 20 characters by 4 lines at a time – enabling you to carry out word processing or data entry as if you are using a large screen.

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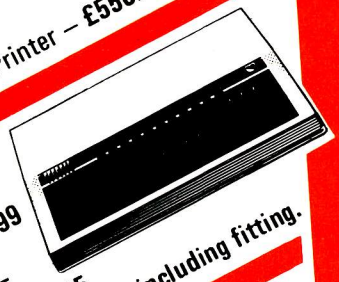

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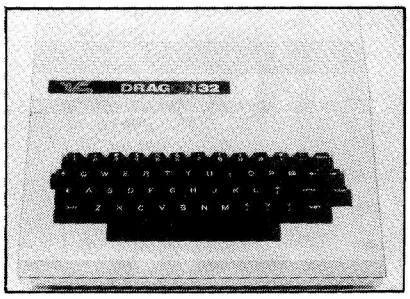
DRAGON 32



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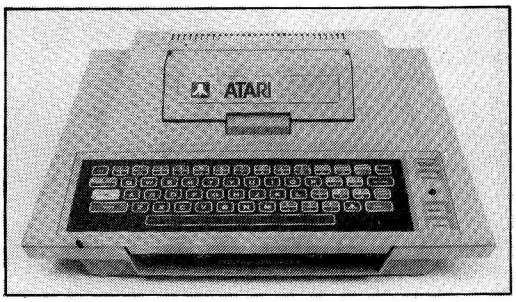

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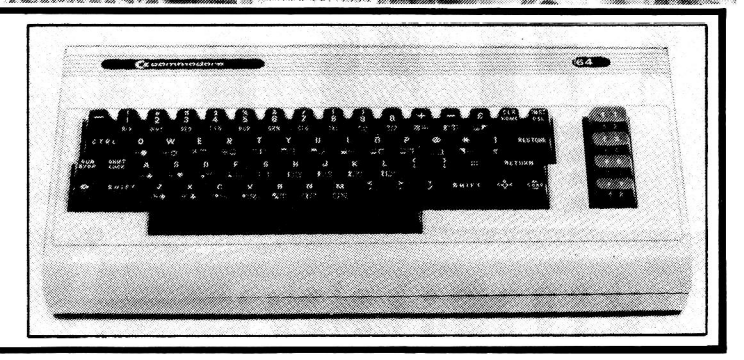

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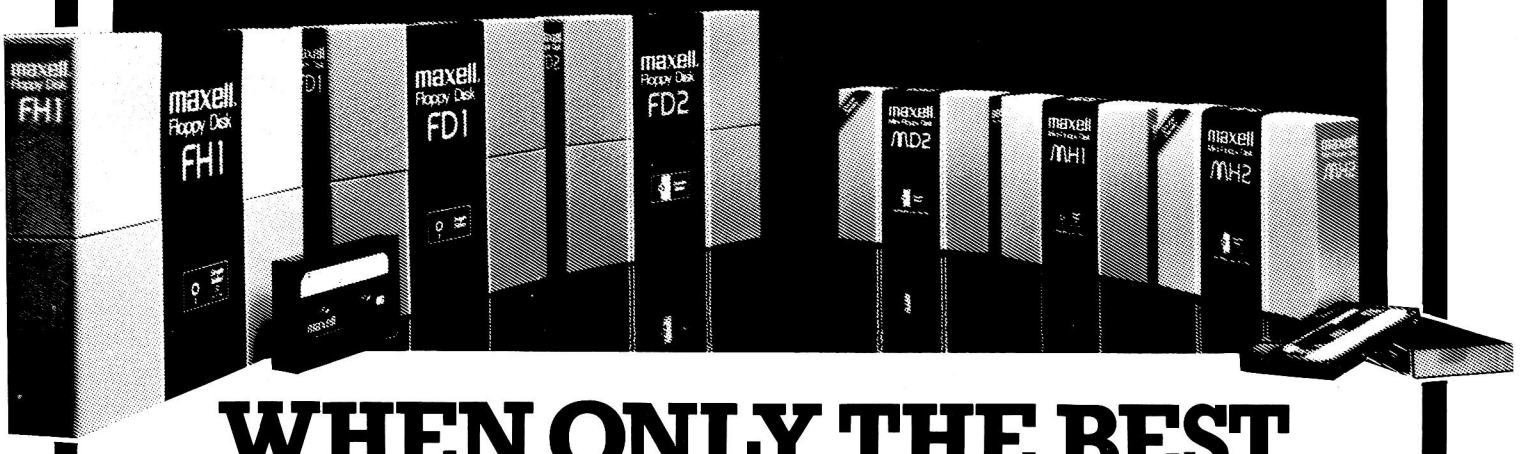

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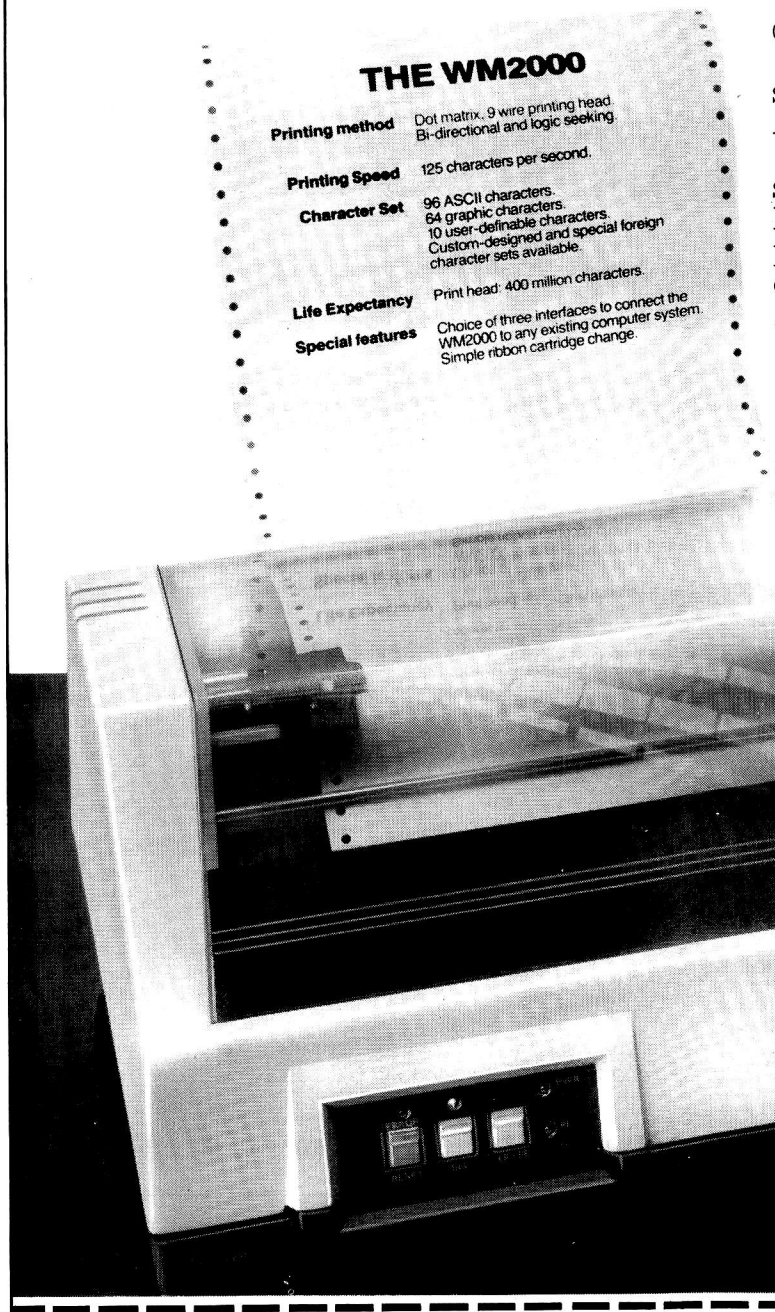

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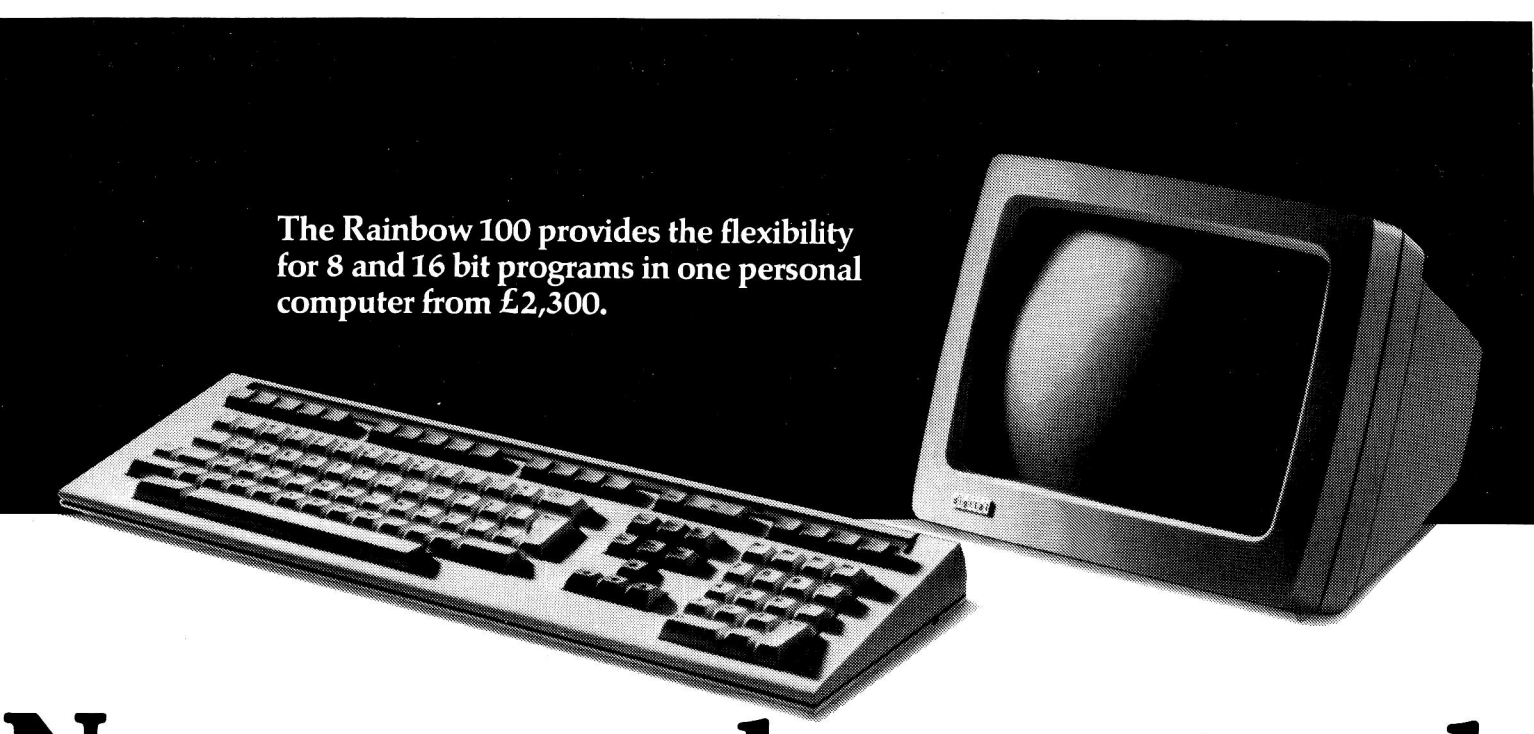

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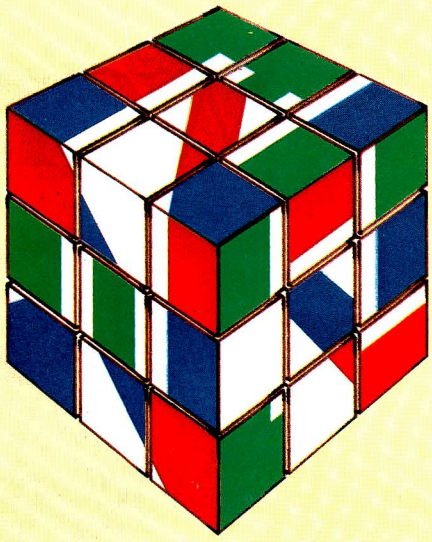

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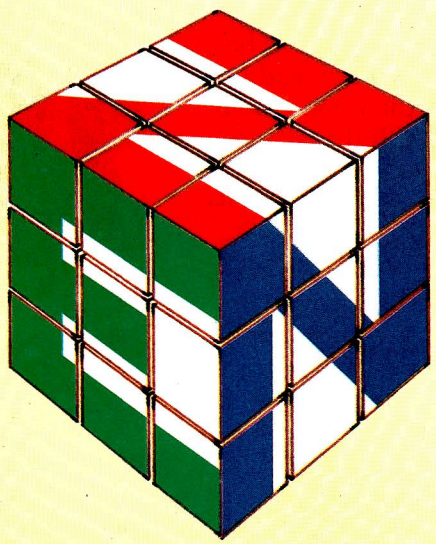

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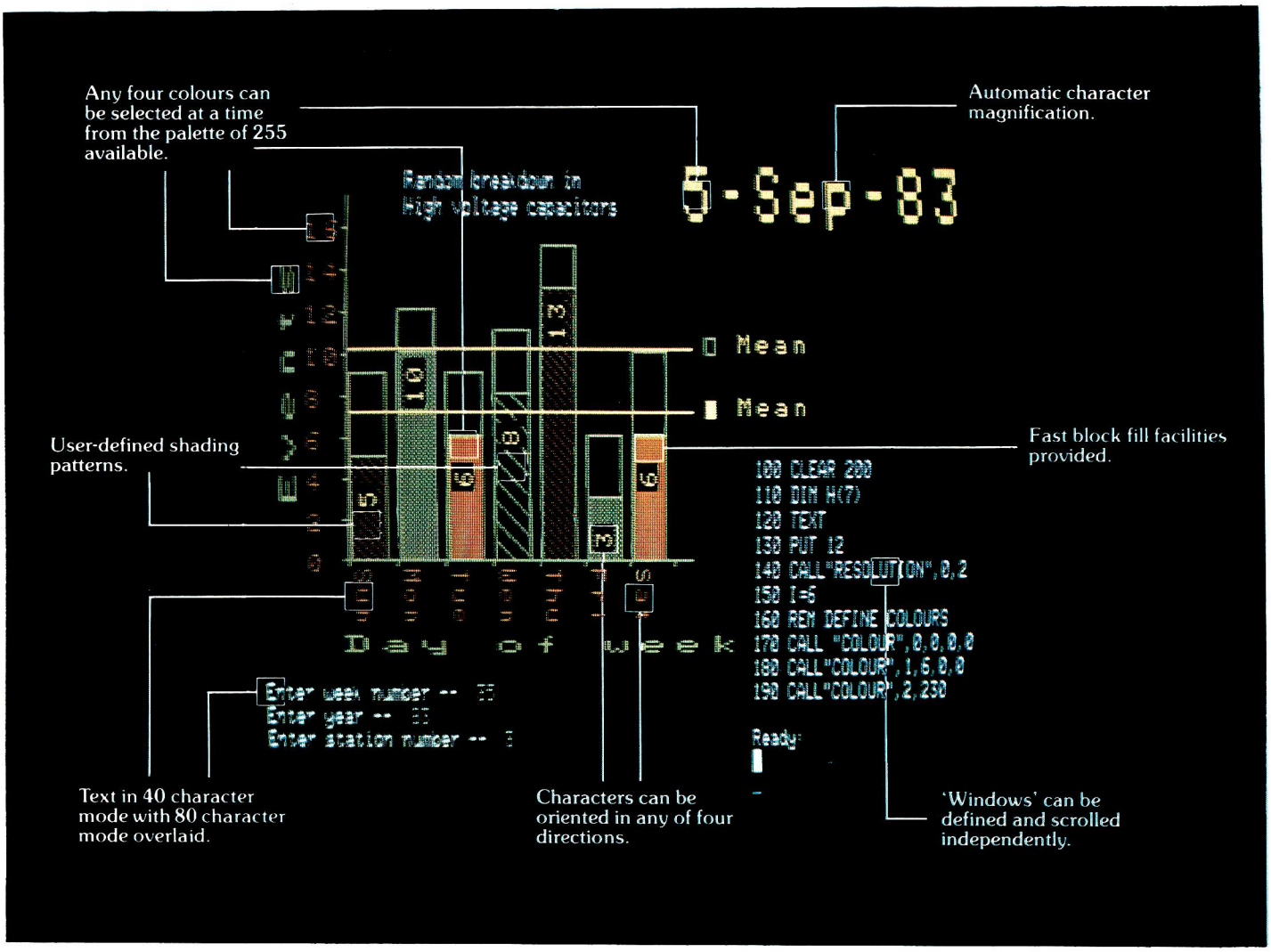

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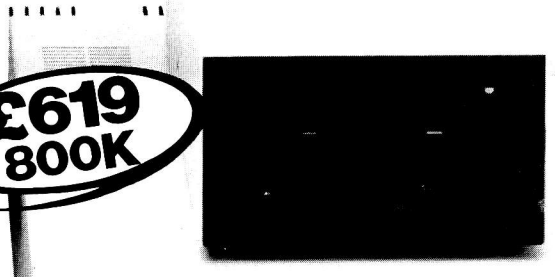

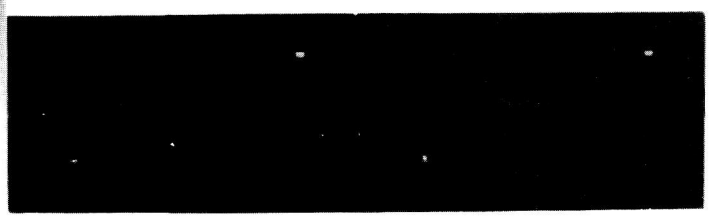

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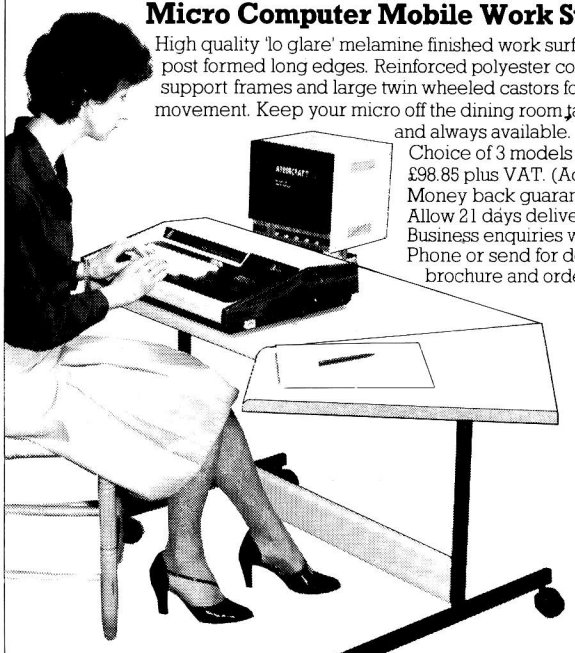

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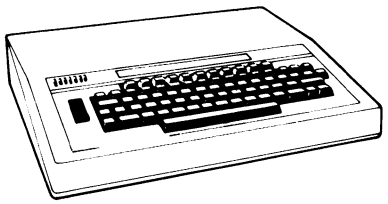

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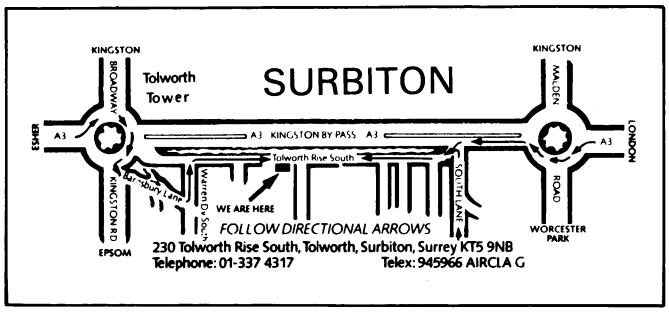

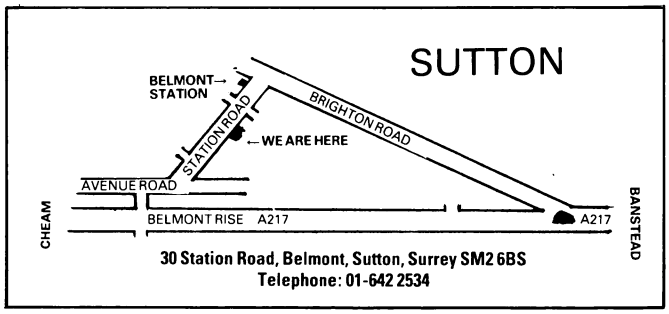

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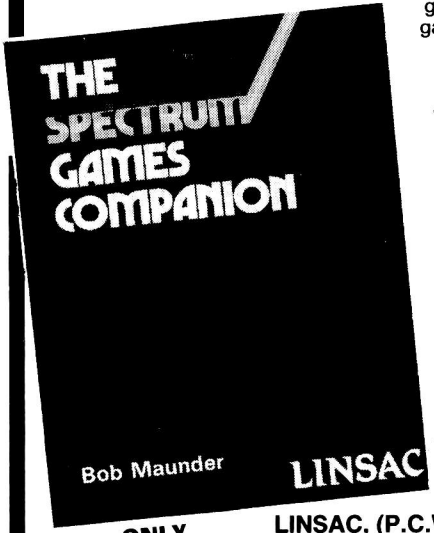

Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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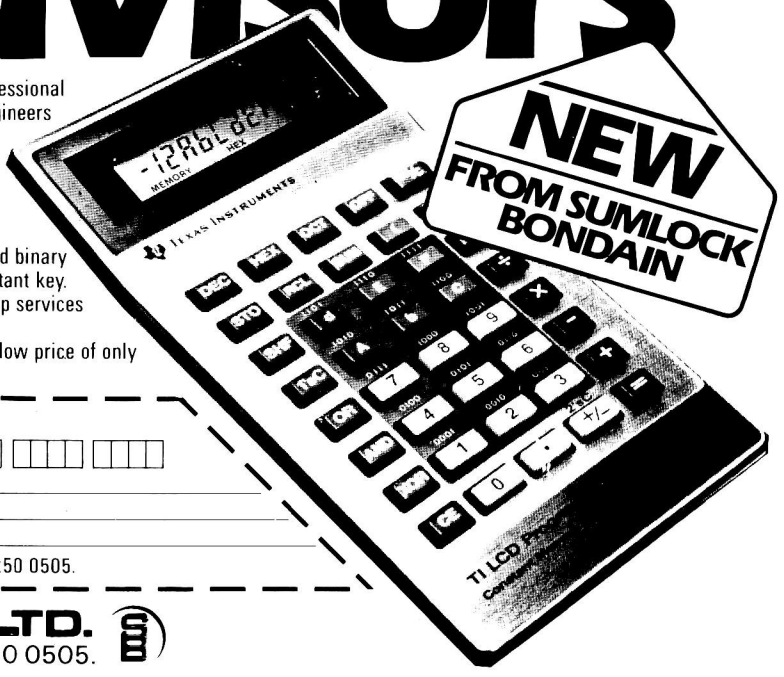

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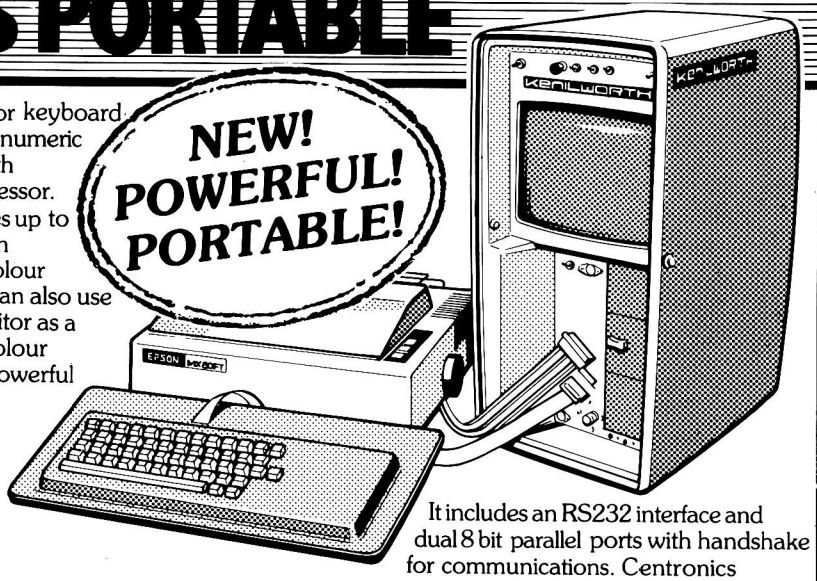

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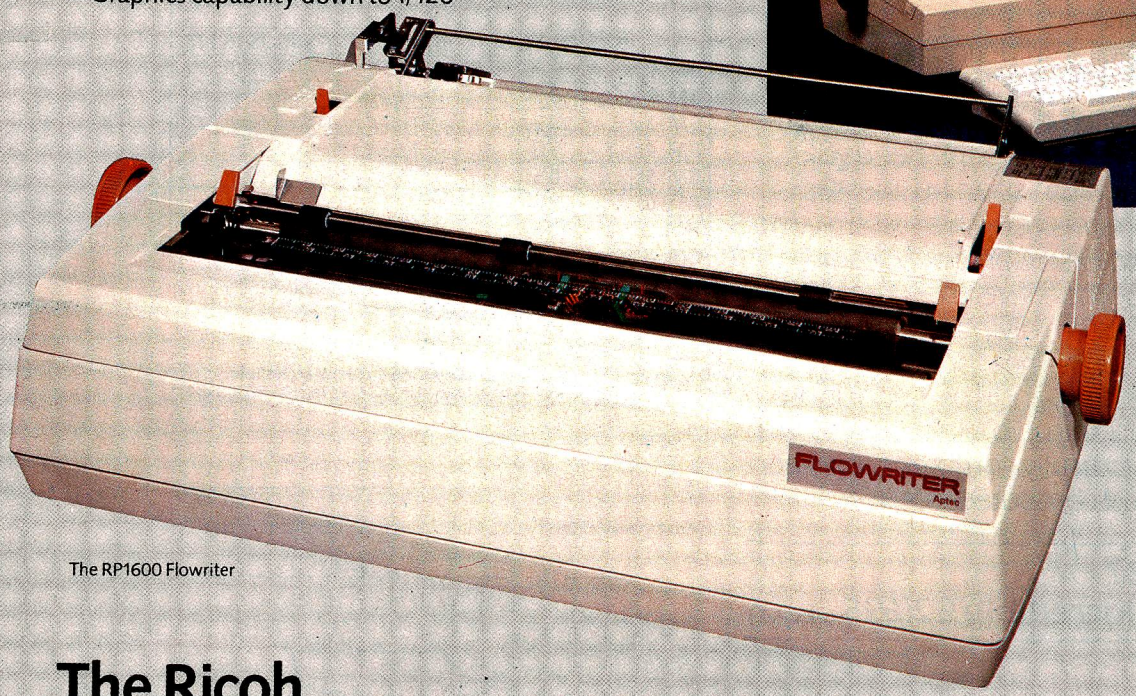

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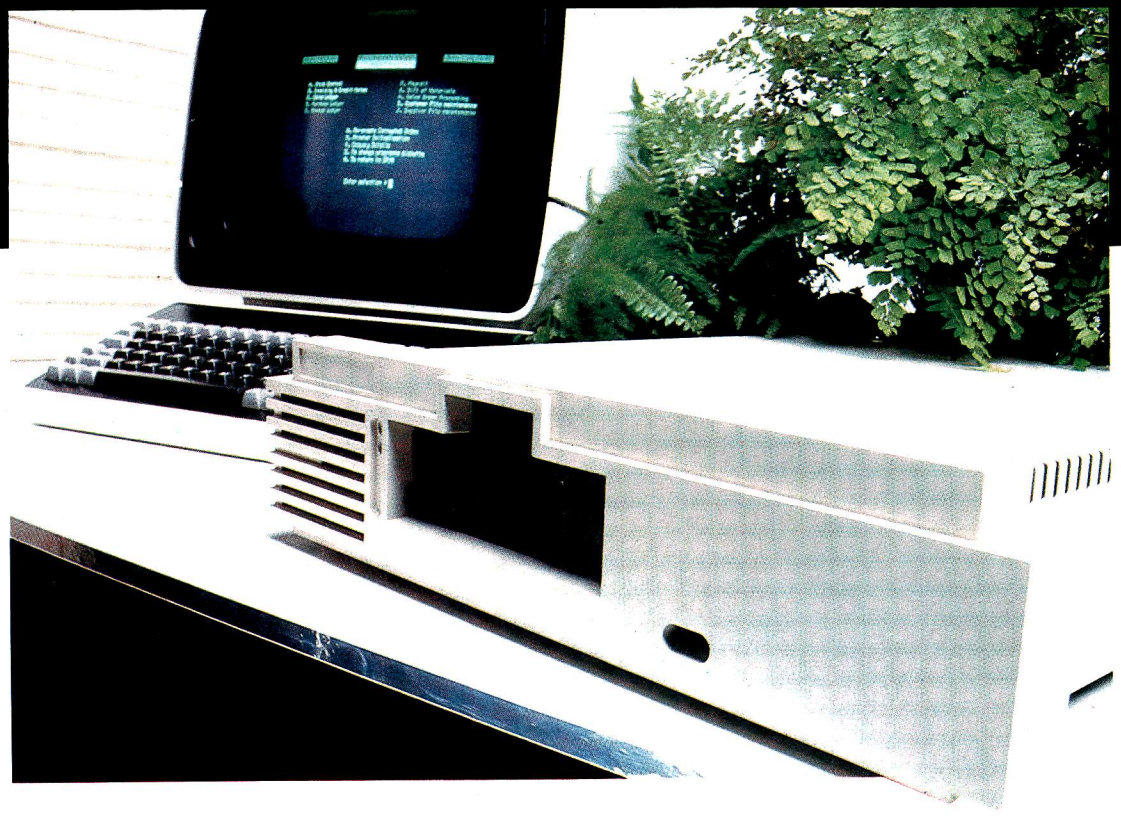

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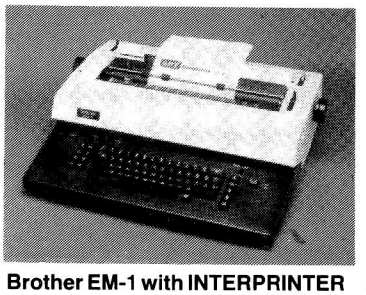

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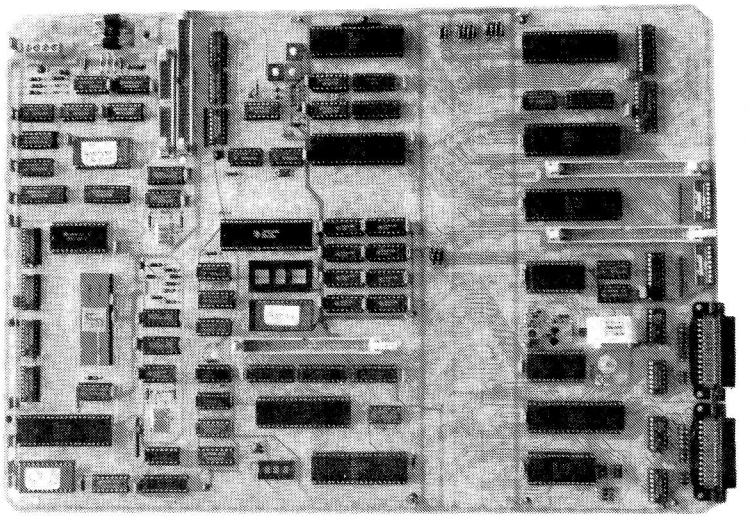

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Our spreadsheet sys
But let's start with

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They allow you to make better decisions by providing better information on budgeting, cash flow, project profitability, Acquisition Appraisal, Lease vs Purchase analysis and much more.

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But which system should you buy? Surely no one system can meet the needs of all businesses?

Fortunately Comshare is not like most companies. We see the need for different systems to suit different people.

NEW USERS START HERE

PlannerCalc at £85.00* is now accepted as the first choice for people new to financial planning.

Designed for 8-bit micros, it boasts the kind of features that you'd expect to pay twice as much for. (Buy PlannerCalc's nearest rival and you'll have to.)

Unlike all other 'calc' products it allows you to enter calculations in a language you understand. Plain English.

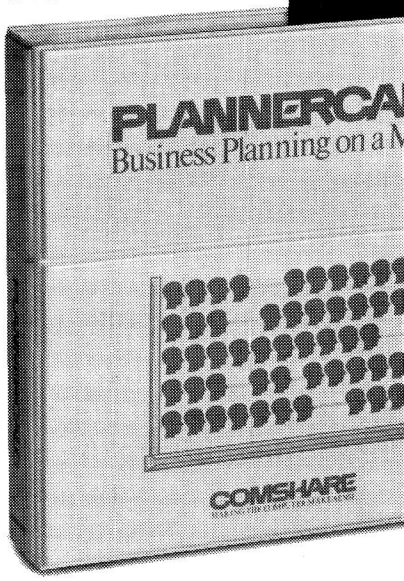
For example:

LINE 1 SALES=100, 150, 175, 210
LINE 2 EXPENSES=GROW 70 BY 15% FOR 4
LINE 3 NET=SALES−EXPENSES
LINE 4 CSALES=CUM SALES
COLUMN 5 YEAR=SUM OF COL 1 THRU COL 4

So it's much easier to use.

It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.

Which means you can enter new figures and rules and immediately see their effect on everything else in the model.



It comes with the best manual on the market and it's suitable for most micros with a ™CP/M 2.2 operating system, 64K of memory, giving at least 900 cells, minimum screen width of 80 characters and 2 floppy disc drives.

MUCH MORE POWER, NOT MUCH MORE MONEY

MasterPlanner is the most powerful spreadsheet system currently available with its increased matrix size, 2000-3000 cells on most 64K micros. (But at £245* it certainly isn't the most expensive.)

Consolidation of models, allows you to create separate plans for each department and then combine them into an overall company

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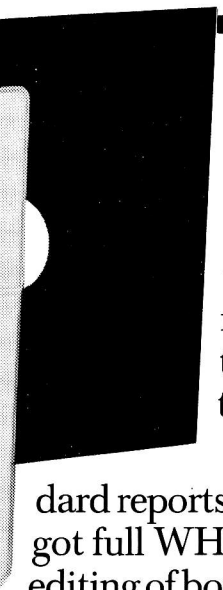


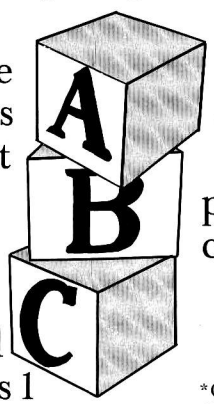
plan. Data transfer to word processing and other systems lets you incorporate figures in reports and output to a data base. It also has extensive formatting facilities which means you can produce reports that wouldn't look out of place in the board room.

It can store up to 25 standard reports to run when you need them. It's got full WHAT IF? analysis and direct editing of both spreadsheet and logic display.

JUST AS EASY TO USE

All this increased power doesn't mean you'll need a degree in advanced computing to understand MasterPlanner.

It works on exactly the same system as PlannerCalc and models written on PlannerCalc run without modification on MasterPlanner.



16 BIT VERSION

A new version of MasterPlanner has been specifically designed for the 16 bit micros like the Sirius 1 under ™CP/M-86 or the IBM personal using either CP/M-86 or ™MS DOS 1.1. With a vast matrix size of over 7000 cells on 128K and even more with larger memory, you'll at last be able to make the most of your micro.

ULTIMATE POWER

Fastplan is the top Comshare micro planning system.

It's file-based, allowing development of large scale models; with a staggering 18,000 cell matrix; full financial functions plus backwards iteration, file input and output; and much more. Yet, because it can be menu driven it is easy to use. For the full story, tick the Fastplan box when you return the coupon.

OVER 10 YEARS EXPERIENCE

When you invest in MasterPlanner or PlannerCalc you're not just getting the best software money can buy.

You're also getting the kind of back up and after-sales service that only a company of Comshare's track-record can guarantee.

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Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of £269.95 including VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.

So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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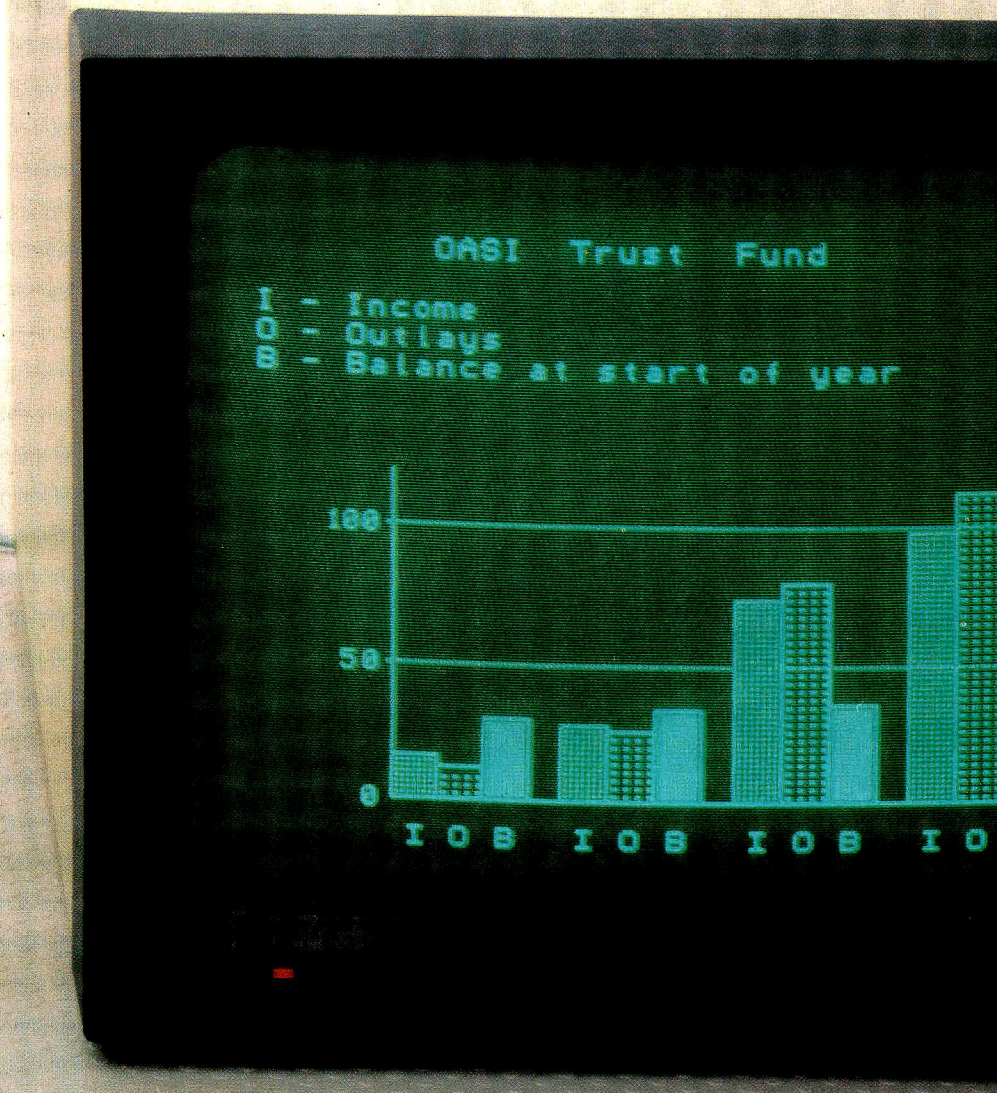

Technical Specifications

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M operating system, and the addition of 5¼ flexible and Winchester disks, 12 green phosphor professional standard monitor, 80 cps professional quality dot matrix printer with pin addressable graphics.

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Software: Enhanced BASIC (ANSI x 3.2/78) Independent Operating System (12 device drivers). Multi Page Screen Editor (32 Control Commands). Maths (10 Signficant Figures). Graphics (Absolute & Relative Plotting, Line & Arc Drawing, Shading, 20 English Language Commands).

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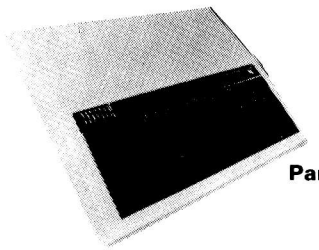

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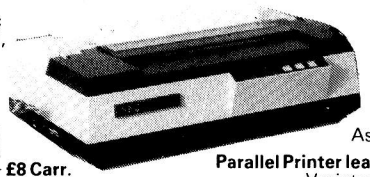

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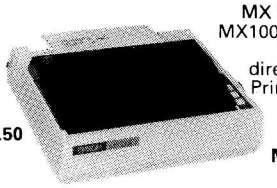

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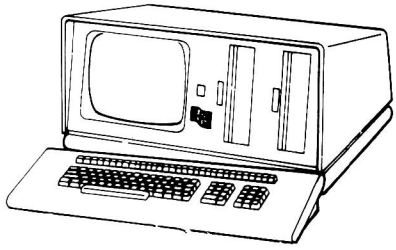

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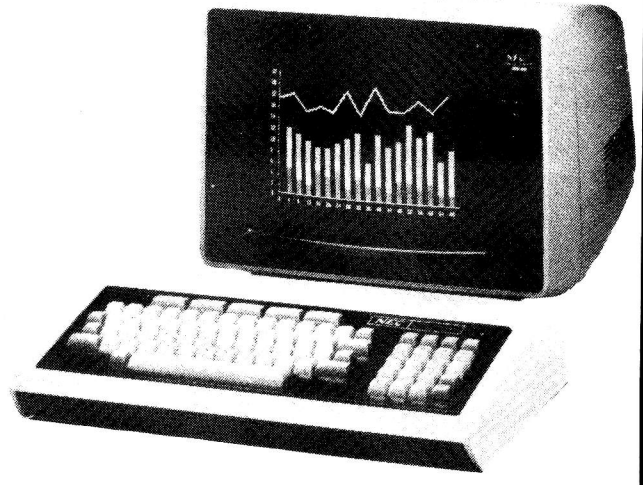

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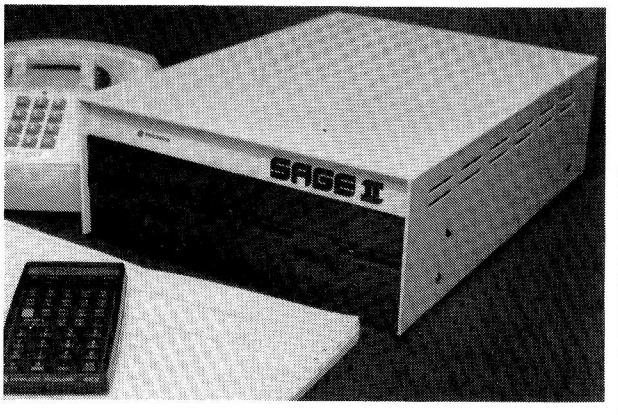

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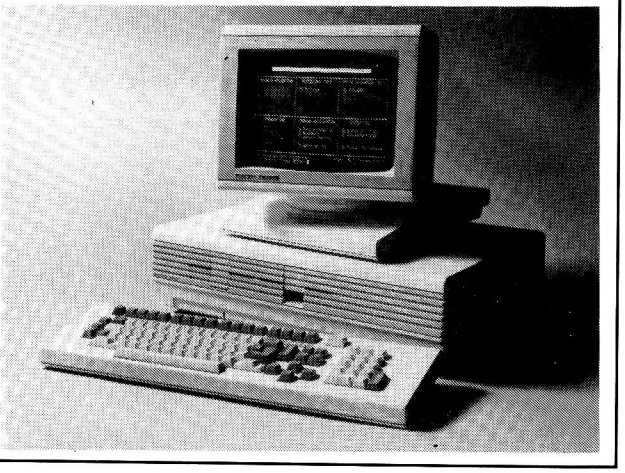

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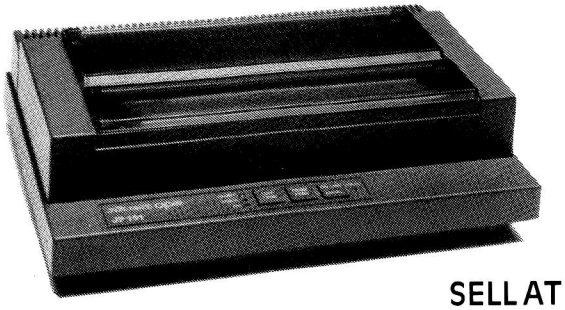

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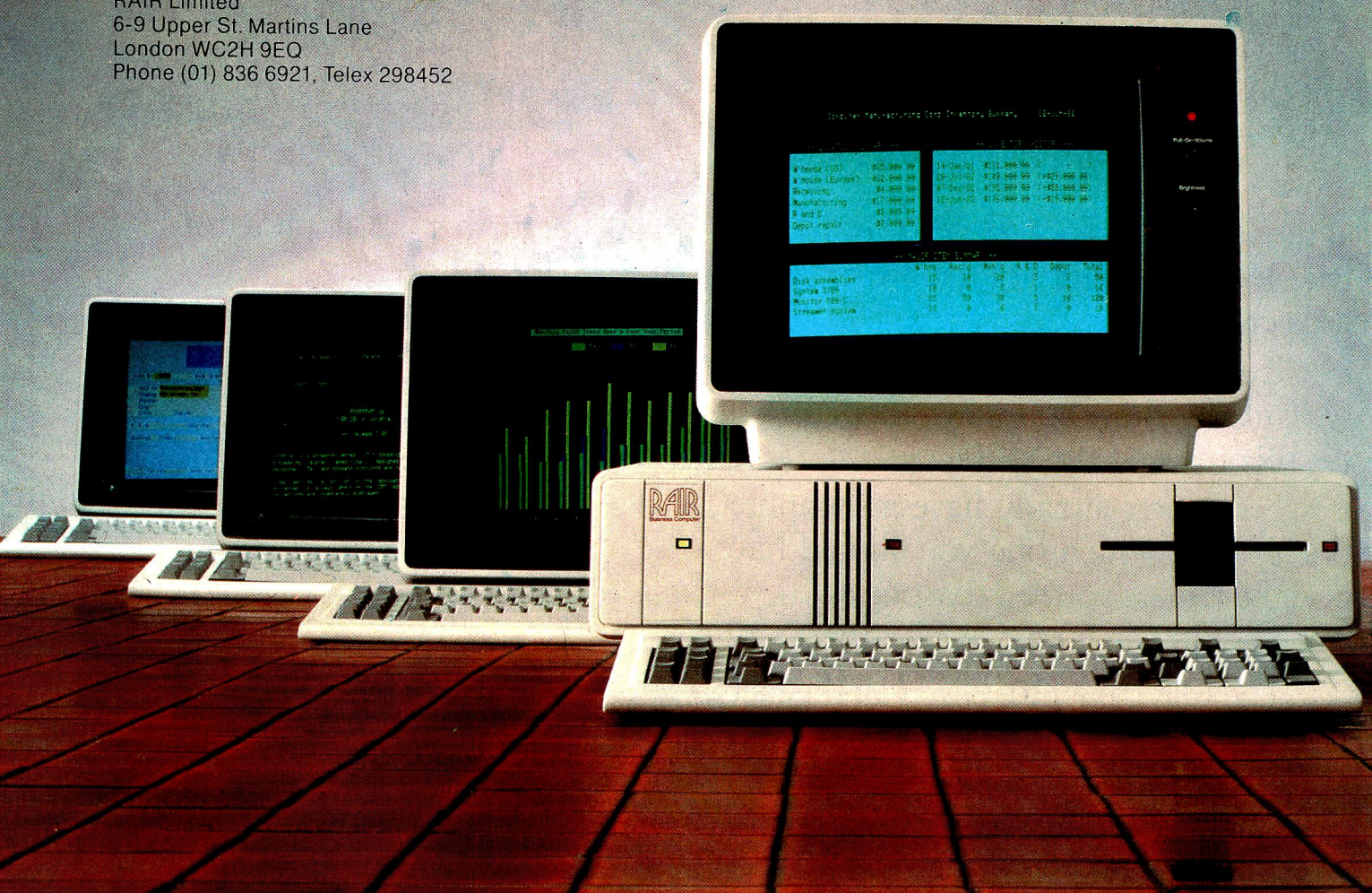

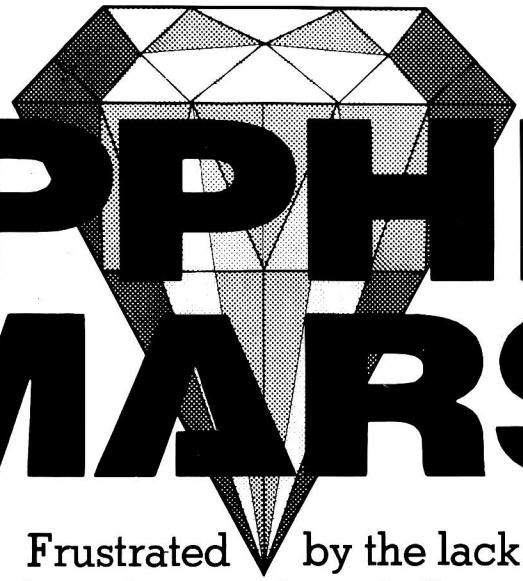

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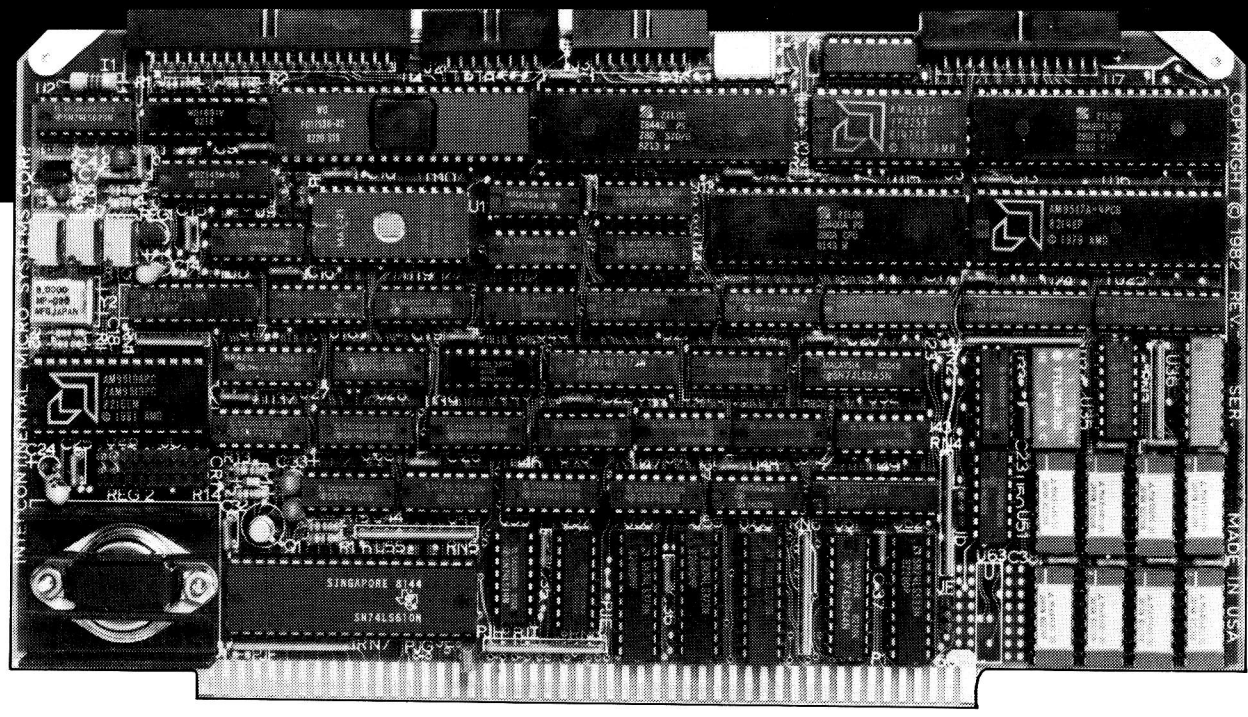

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- Four channel DMA controller.
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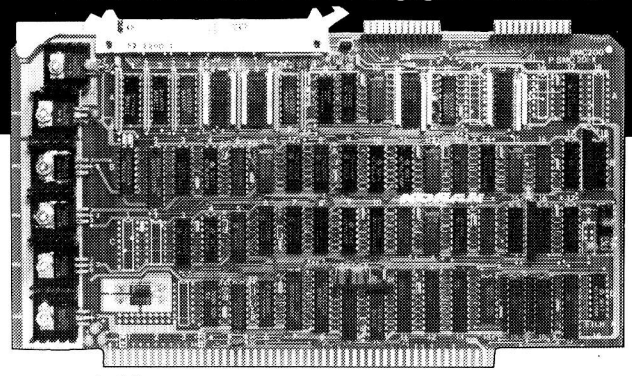

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Guy Kewney provides the latest micro news.

Bowler-hat micros

Like every big organisation, the Civil Service suffers from highly efficient managers who believe that everything should be brought under their control – and that this should include a nice, standard microcomputer. So, a year and a half ago, they produced a list of 'the best' micros and told Government staff not to buy anything else.

This year, they have been a bit more sensible. They have also uncovered a pearl, in the Videcom Apollo.

Once again, the Central Communications and Computer Authority has produced its Top Ten list and has told the approved suppliers to be prepared to give micros to Civil Service buyers at the drop of a hat, because all the forms have been filled in.

The difference between last year and this (apart from a couple of name changes) is that this year's list isn't compulsory and things not on the list are not forbidden.

The original dream was that every Civil Servant would end up with the same micro. This would mean that engineers would be easy to train, and would carry only a small list of spare parts and test equipment. Software would be able to run on every machine. Disks from one user could be slid into another user's machine and the text or the figures read into memory. And, best of all, the supplier would sell the things at a big discount.

It is now recognised at the CCTA that this dream will remain a dream, simply because there is no way to monitor these machines closely enough. If an executive wants a Sirius, and can spend £3000 or so without getting a more senior person to okay it, a Sirius is what will appear on that executive's desk, no matter how much black ink may say it should be an Apple. And vice versa.

The Civil Service list of micros this year includes the Sirius, the Apple II and III, the Comart Communicator, and several other machines of more or less respectable pedigree, such as the ICL micro (the Rair Black Box) – but not one of the Commodore range.

However the authorities accept that knowledgeable buyers may want other machines – for example those who have one Commodore machine might want another one for the department on the very sensible grounds that they can swap disks (etc, etc) or that the Commodore machine is the biggest-selling business micro in the country, or whatever. In that case, say the authorities, let the knowledgeable buyer buy what he or she knows.

'It is more intended as a guide for those of our staff who find they need a micro and really haven't a clue what is on the market, or what machines really aren't suitable,' said one Authority (anonymously, of course).

The surprise in the list was a machine called the Videcom Apollo.

It turns out to be a £2000 CP/M system with a very nice display, enormous disk capacity (a 1.6 Megabytes total) and a truly amazing £1500 add-on which lets it talk to almost any other mainframe computer like an old friend.

The reason nobody has heard of it is that Videcom doesn't sell through dealers but direct to its existing customers, who are large organisations (like the Civil Service).

The company is based in Henley, is expanding like mad, is planning an IBM lookalike (but faster) which will retain its normal CP/M profile as well; and its boss, Keith Barker, appears resigned to being dragged, kicking and screaming, into the retail micro business by people who want to buy his products.

Details from Videcom on (04912) 78427.

But the world, it seems, must wait for an explanation of one strange detail of the CCTA 'approved micro' list.

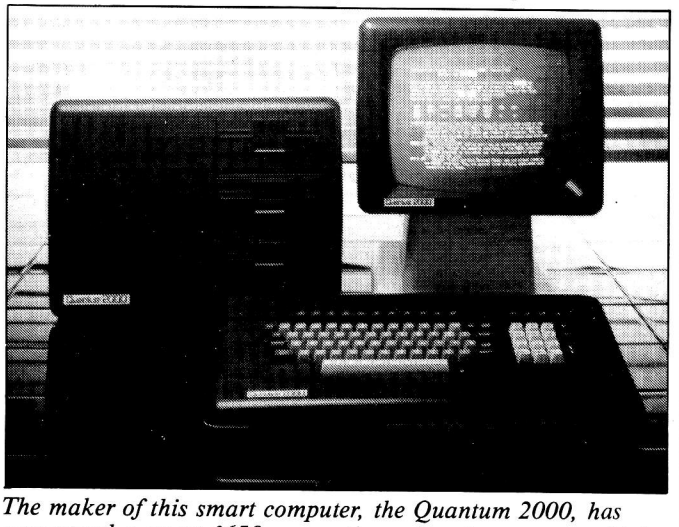
At the official announcement, poorly attended by journalists (it was on a Monday, and the Press invites went out on the Friday) somebody apparently asked why the Apple II and the bigger Apple III were both on the list.

Somewhat to the puzzlement of those present, the answer sounded very like 'because we couldn't tell the difference'.

Seeking confirmation of this strange utterance, your reporter contacted the Official Spokesman, who said yes, somebody did say that.

'Why do you ask? I'm not an expert: would that have been an odd thing to say?' enquired the Official Spokesman.

The Official Spokesvoice was last heard promising a) to 'obtain clarification' and b) to call back the next day. We will probably never know which of the two tasks proved the more difficult.



The maker of this smart computer, the Quantum 2000, has announced a smart £650 accounting suite of programs, which, it says, 'can search 4000 entries in three seconds.'

The Quantum was upgraded at the recent Which Computer? *Show, with the announcement of extra-large disk storage – up to 40 Megabytes — and high resolution colour graphics. The system software is called Quibs, and it will also run on the Gemini Galaxy-2. Details from Brian Wingfield at Quantum on Leeds (0532) 458877.*

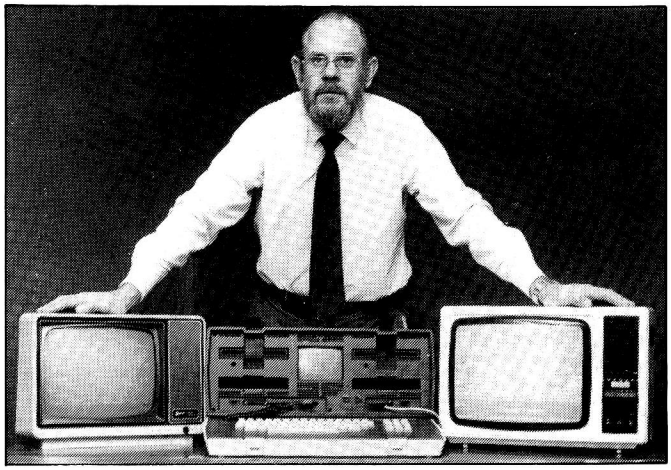
InVisious

'It would be invidious to mention names,' remarked Tony Riley recently, 'but if a program name starts with "Visi" then Version 4.0 of Copy II Plus will copy it.'

Tony Riley is managing director of Orchard Software, a company which enables Apple users to free themselves from the paranoia of software producers for a mere £35 plus VAT.

I am going to reproduce Riley's announcement, which is the only enjoyable press release received here this year. 'Riley is adamant that Copy II Plus does not make any difference to the piracy scene: "When I read yet another article about rampant piracy, I just have to yawn – our customers are mainly big business types who will happily pay for their software, and who just won't risk using pirated copies – but they do need backup."

'And, of course, being the latest weapon in the war of protection versus backup, Version 4.0 comes equipped with all the newest methods of



Without the presence of the boss (Ian Dunkley at Sheffield dealer Datron) towering over this scene like King Kong, readers might think that the two screens on the side were enormous, and not realise that the little Osborne in the middle really did have a five-inch diagonal display.

Dunkley's firm has produced a little £35 extension to the video outlet which lets the user plug in a standard monochrome monitor, or a standard UHF television – and still watch the original Osborne screen.

There was a little device called a Monadapt which did it for Osbornes before they were put in the new smart case, but the new smart case didn't have a place for it and it didn't give a TV output. One day, somebody ought to look into the reasons why people want a bigger screen. It is a well-researched fact that the more the eyeball has to scan, in order to read a document, the more fatigue is caused. That is why Newsprint is kept to around 30 characters per line in width – it's easier to read quickly. And this print – this very line you're reading now – is significantly smaller than the print on the littlest screen above.

Anyway, people buy what they think they want, and Dunkley will sell it to you on (0742) 585490.

cracking protection systems. In fact, if, over the last year of controversy, you have become curious about such things as "self-synch bytes", or "synchronised tracks", and "nibble counting", you might enjoy the very readable chapter on disk protection schemes in the Copy II Plus manual.

'Even though it uses the most up-to-date cracking routines which are themselves very complex, Version 4.0 is very easy to use – many of the best-selling business packages can be copied in 45 seconds without getting involved in any technicalities at all. Copy II Plus also formats disks in less than 25 seconds, which is about five times faster than the Apple DOS master disk.

'Perhaps the producers of bit-copiers are getting a bit defensive about their products after all – Copy II Plus describes itself as "An Apple Disk Utility System" and contains 20 other careful utilities quite apart from the bit-copy program which is causing all the fuss. If you want to change the "boot" program (that is the program the system automatically loads when you switch on) – it is an easy four-key operation. Another useful feature is the ability to check your disk drive speeds – which gives you early warning of the need for a service call – before you start losing important data.

'A final word from Tony Riley: "We expect to be offering a bit-copier for the IBM Personal Computer soon, now that it is being marketed here in the UK. That will probably cause yet another round of indignation from people who refuse to face facts. Serious users need reliable backup – and we're in business to provide it."'

End of quote.

Details on 01-580 5816.

Tandy goes CP/M

One of the most stubborn rearguard actions ever has been fought by Tandy, supplier of Radio Shack computers, in an attempt to avoid supplying CP/M to its customers.

The battle has suddenly been abandoned, with the news that most of the bigger Tandy systems will now get the new version of CP/M (CP/M-Plus) – which lets users run enormous disk storage and very long programs.

The operating system won't run on the very popular original Model I (now obsolete) but will run on the Model III, the 68000 based model 16 and the old Model II which was the only one previously to have CP/M at all.

Details on (0635) 35304, or from Tandy dealers.

Power Forth

The language Forth has been available for BBC Micro users from Level 9 Computing for four months: the company has now added a £10 package which considerably extends its power.

The package is called the Forth Toolkit and includes such items as the Logo Turtle, a full 6502 assembler which allows 'structured' logic in its programs, a de-compiler to help unravel the esoteric Forth instructions which you wrote last month and can't understand any more, and extra arithmetic facilities.

It also admits to the existence of games joysticks, cassette tape storage, and printers.

Details on (0494) 26871.

APL for IBM

IBM actually invented the language APL as the world's first serious attempt to provide personal computing: it was 'A Programming Language' which people outside the computer room could use to write their own financial programs. So it is a bit strange to find that APL Plus, a company based in Covent Garden, is putting the language on the IBM Personal Computer.

Originally, APL was used only on giant IBM mainframes and when micros appeared it was accepted that they were too small to accommodate the interpretative code that turns APL instructions into computer actions.

At the same time, several people outside IBM were improving on APL, to provide an easier-to-use way for their customers to go. They supplied extended APL on time-sharing networks, where the customers phoned in from remote terminals.

One such time-sharing network was STSC, which developed the version of APL known as APL Plus – which is now available on the IBM micro for £600.

The features of this version as listed below will mean little or nothing to people outside the IBM or APL community of experts. For those people, we can recommend that they get a system with 128 kbytes of memory, two disk drives, and a mathematical specialist chip (the Intel 8087) installed and start from square one.

For the well-informed: the list reads as follows — all APL Plus extensions (replicate, diamond separator, and so on). Full FMT business report – formatting feature. The component based share-file system. Error and event handling. 106 system functions and system variables, plus system functions for full screen control. Interface to non-APL programs and data. Two terminal modes – either through simple standard ASCII codes, or simple APL characters on the one hand, or a complex 'smart mode' which uses the comms port under APL control.

The interpreter will be able to make sense of PCDOS files generated by other programs using the IBM operating system, and can provide a workspace of between 36 kbytes and 500 kbytes.

Details on 01-240 5765.

New from Almarc

Just by coincidence: should anybody be looking for a computer on which to run the APL Plus interpreter mentioned elsewhere, Almarc has announced the Series 16.

Its specification reads: a system with the Intel 8086, plus the 8087 mathematical co-processor; 128 kbytes of memory as standard, expandable to a Megabyte; disk options from 1.6 Megabytes of floppy to 20 or even 40 Megabytes of hard disk (the latter capacity needs an expansion unit).

This system will cost £3000 or more, without the (essential) terminal display or printer or keyboard – and the company makes no mention of APL at this stage.

'We offer CP/M-86 as the resident operating system,' said Almarc chairman Alan Hood when announcing the new machine. 'In the near future, we shall also offer MS DOS, and MP/M-86.'

Other operating systems, including APL, 'are being looked into'.

The company is in Nottingham, on (0602) 52657.

Le Logo

The first European computer company to acquire the language Logo from Logo Computer Systems Inc (LCSI) is a French one, Thomson Brandt.

All over the world, there are people who are becoming impressed with this new language, which Dr Seymour Papert invented when he was at Massachusetts Institute of Technology.

It is apparently much better for the purpose of teaching computer programming than Basic. There is only one snag: what, actually, is Logo, and what isn't?

The difficulty is enhanced by MIT's refusal to allow anybody to sell Logo by describing it as 'MIT Logo', whether it is, or whether it isn't – though there are some firms who do this anyway (whether it is, or whether it isn't).

When it comes to LCSI Logo, some of the anxiety (caused by the company's description of its staff as 'including many former members of the Artificial Intelligence Laboratory at MIT, regrouped to produce entirely new and improved versions of Logo') is dispelled by the fact that Apple, Digital Equipment, and Atari all use this version.

That means that most people writing Logo programs will be doing it according to LCSI rules.

The rest of the anxiety, probably, will dissipate when you hear that Dr Seymour Papert is himself a director of LCSI. Details phone 0101 – (514) 937 7771 and ask for John Hutchinson.

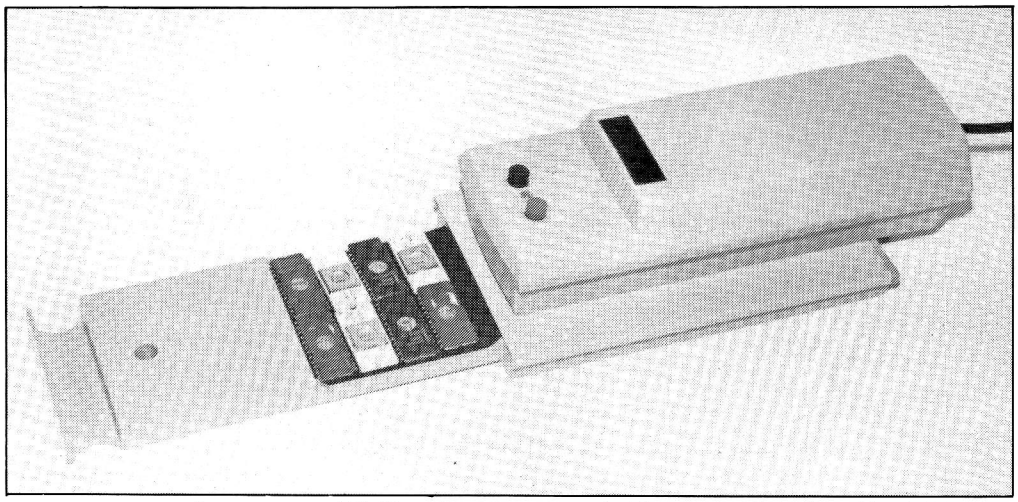
Epsoft

All that is needed to turn Epson's portable HX-20 from a rather clumsy calculator into a very swish computer is software and the first few programs are starting to appear on the market.

First announcement to reach this office comes from Maidenhead-based Kuma, which has produced a 'home budget' package for £17.35 (plus VAT).

It is described as 'allowing the user to keep comprehensive track of mortgage, rates, credit cards, rentals, heat/light, housekeeping, car/travel, clothes, entertainment, and all sorts of sundries' – if you remember to type all the information in.

Full details on (0628) 71778.



Taking pity on computer hobbyists who have been blinded by using ultra-violet sun-ray lamps to erase EPROMs (because official erasers were too costly) Hi-Tek Distribution has decided to tell the world about this, the DE-4. It exposes the memory cells to powerful u-v in a light (and u-v) tight box, until the electrical charge is dissipated, and they have forgotten all they ever knew, and are ready to be reprogrammed. A mere £36. Details on Crafts Hill (0954) 81931.

Lisa software

To measure just how hard Apple is going to have to fight to establish its Lisa as a credible foundation for its future wealth, consider the simple fact that already, Unix and Cobol and CP/M-68K are available as background software for the machine.

That means that programs which rely on Unix routines to do the mundane work of putting letters on a display screen, or characters on a disk, will find all the right routines ready and waiting, and so they will be able to run. The same with Cobol programs – and one day, when Digital Research has actually got a few CP/M-68K installations live and well in software houses, there will no doubt be programs which use that operating system, too, and then they will run.

Ordinarily, that would be splendid news for a new machine.

In the case of Cobol, Micro Focus is known to have had a Lisa machine for more than a year, and must have got the system working properly.

In the case of Unix, the 'port' – the process of moving the pre-written code into the right part of the Lisa memory – was completed by Root Computers (or its American parent, Unisoft) as long ago as last June.

The trouble is that Lisa, said to cost £7000 +, justifies that (not inconsiderable) price on the grounds that it 'gets right away from the concept of loading and running a program'. It certainly does. Anybody who has ever seen the thing and had a chance to move its 'mouse' round the desk has been delighted with it.

Instead of having to 'load' and then 'run' a word processing program, before you could type a letter, as a Lisa user all you have to do is put the little arrow on the screen over a picture of some paper, and start typing. Instead of having to 'load' something like Visicalc, you reach for another bit of paper, call up the function that looks like Visicalc and it too, appears like a sheet of paper on the same screen.

And you can move things from one to the other, and include a spreadsheet section in your financial document, or pick out a bit of text from a letter and move it into the spreadsheet. And you can even take the spreadsheet figures, and pull them onto another bit of paper with the graphics function, and turn them, automatically, into graphs, or pie-charts, or bar-plots. And you can draw pictures of your company logo on top of the paper, and then print it out, any size you like.

It's all wonderful and I want one myself. But, unfortunately, it won't get the double-entry bookkeeping done. It won't be much good for stock control, either.

The good news, of course, is that you will quickly find a stock control package, or a bought ledger program, or even an integrated accounting system, just the way you always wanted, which runs fine under Unix or Micro Focus Cobol.

You can load it and run – and instantly your £7000 Lisa has turned into an expensive version of the £3000 Sage. With fewer operating systems or language compilers, to boot (sorry). And the mouse is just something to lose under the pile of paper, or trip over.

What it boils down to is that Apple is on two stools, for the moment.

There are, on the one hand, a great many microsystems using the 68000 chip, the same one that Lisa uses, which are perfectly ordinary minicomputers. They cost around the £10,000 mark, and generally they run Unix, and allow something like 10 or more people to plug terminals into them and run programs at the same time. That works out at rather more than the £1000 per head one might think, because of other factors like the costs of terminals.

It isn't an ideal way of doing the work, but in an office where there are 10 or so people all doing roughly the same sort of work and not too much of it, it can work out cheaper than buying 10 micros.

On the other hand, there are single-user micros, like the Sage, which use the same chip but cost far less – around £3000 or so – for single users.

It's a bit as though Apple were approaching car-owners who drove Ferraris, and selling a car costing three times as much, which could go quite a lot faster along a straight road – but cornered like a double-decker steamroller.

To rescue themselves from this, Apple is planning to let software companies use a set of programs called the Software Tools.

These Tools will let the programmer take his own design of accounting and stock control programs, and integrate them into the Lisa view of the world, controlled by the Mouse.

The trouble is that the Tools (and Lisa itself) aren't expected in this country for several months. Apple executives talk of 'the summer' without any degree of precision – and, indeed, with a confusing amount of mutual contradiction, as the time when programmers will start getting them.

Eventually, the office dream will be upon us: a customer will call up the computer from his own micro, order a number of products, and get automatically billed, discounted, credit-assessed, and have all the figures stored in the stock transaction, in a form which can be printed out at the end of the year in the company report – while the user is actually engaged in designing a new company letterhead, and calculating the dimensions needed to have it fold five times into a Post Office Preferred envelope . . . but, I'm afraid, not this year.

The version of Unix, by the way, is impressive. Unisoft includes many important enhancements currently being perfected at Berkeley University under Unix 4.1.

It also offers a complete list of the type of software which experienced users will recognise as essential – editors, sorts, text processors (NROFF and TROFF) plus the languages C, Cobol, Pascal, two versions of Basic, and Fortran and a CP/M simulator called Bridge, and Ada. There are also spreadsheet calculators, word processors, and relational database management systems. Details of all these from Root Computers in the UK, on 01-726 6501.

New Computer Revealed

The ancient multi-national corporation with that olde worlde sounding title National Cash Register (NCR) has stepped into the modern age with the launch of a professional personal computer.

Called the Decision Mate V, the machine offers dual 8-bit and 16-bit processors, the Z80 and 8088, two 320 kbyte floppy drives, keyboard and 576 by 432 high resolution screen. The standard model has 64 kbytes RAM and a further 32 kbytes RAM specifically to allow graphics to be used without degradation to the speed of the main application. A colour version is scheduled for June with 96 kbytes graphics RAM.

But the chief selling point is the do-it-yourself, easy to assemble, modular profile of the system. NCR is styling the Decision Mate as a machine which the first-time user can plug in, switch on and start using. Even the local area network, which is an own badge version of the Corvus Omninet, is simply plugged in.

The central filestore is then addressed as a third disk drive. (In fact access to the hard disk file store is 20 percent faster than access to local floppy disk drives.) Data travels round the network at a speed which sends 10 A4 pages of text from one personal computer to another in one tenth of a second.

One unusual feature of the system is the extensive diagnostic facilities. Here NCR has decided to cater for those end users who want to be able to find out what is wrong themselves, and also – some of them – to fix it! There are eight LEDs relating to different components of the system and these will light up when you switch the machine on if there are faults on their respective components. You can also buy a plug-in diagnostic module for more detailed examination of the system.

NCR is offering its standard mainframe, on-your-doorstep service for failures and reckons this will be economical for Decision Mate V users because the predicted failure rate is once per machine per two years.

Planned enhancements include a 32-bit processor model in 1984.

The keyboard has 20 of the familiar programmable function keys and there is a removable template that can be used to remind you what each key is programmed to do in a given application.

On the back of the keyboard are switches to reconfigure the keyboard for different languages: US English, UK and International English, French, German, Swedish/Finnish, Danish/Norwegian, Spanish and Italian. The keycaps are also removable and the keyboard has a joystick socket.

Jane Bird

Keen nets IBMs

Newly-appointed IBM micro dealers are being wooed by Keen Computers, which hopes to sell local area networks through them.

The bait is the attraction of sharing the extra storage capacity of hard disks, by plugging several IBM micros into a Corvus Omninet – and also plugging Apples into the same disk.

The same network can also accommodate the Keen-distributed Corvus Concept. 'A new, high performance Omninet,' says Keen, 'can now link more than 60 IBM Personal Computers, over 4000 feet.'

Details on 01-236 5325.

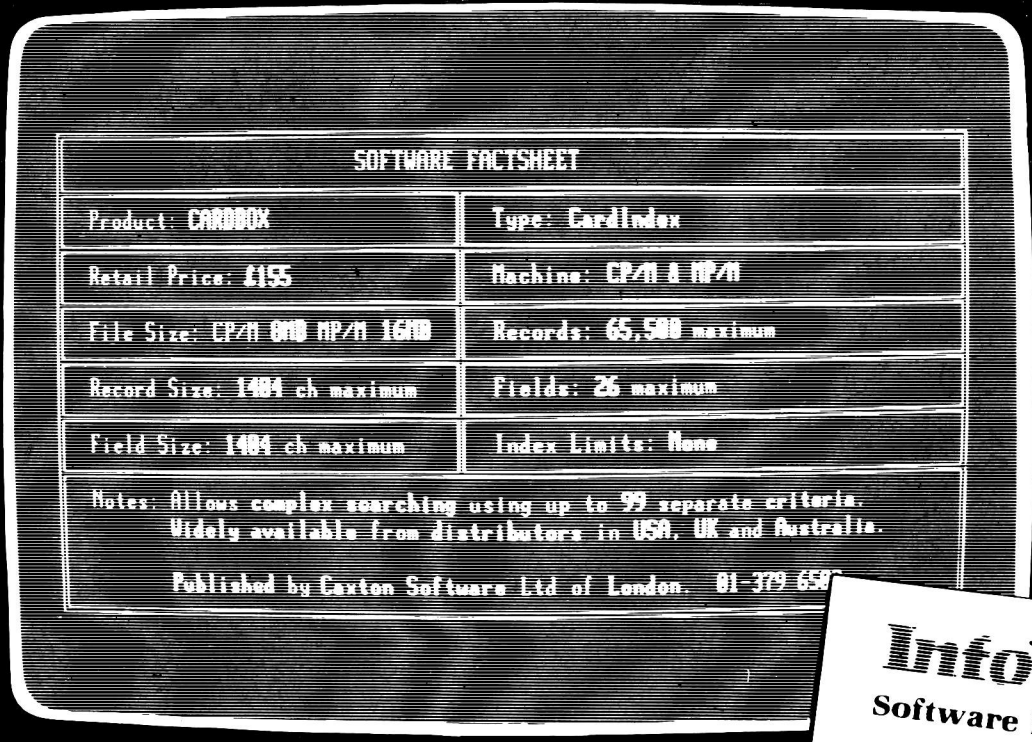
Net chip

For electronics experts, the idea of a local net has become at least one degree simpler, with the release of a chip which can interface 'any 16-bit processor to Ethernet'. according to distributor Pronto.

Pronto is selling a chip called Lance (an acronym for Local Area Network Controller to

NCR's new Decision Mate — see 'New Computer Revealed'.

Still Need Convincing?



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InfoWorld, September 13, 1982

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Caxton

Caxton Software Ltd, 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

Ethernet), which replaces the immense amount of logic circuitry – enough to cover a fair-sized circuit board – which would otherwise need to be put together by highly qualified experts.

That is not to say that beginners can now join in the fun.

This chip may handle the protocols involved in Ethernet net standards – but building an interface using the chip still would involve considerable engineering expertise in clock signals and timing, in microcomputer operating software design and in system building.

The Mostek chip, the MK68590, can be researched further by phoning 01-554 6222.

Power box

If ever there was a company to prove that software is more important than 'state of the art design' it must be (after IBM) Altos. The Altos Series 68000 is about to prove it yet again.

Unlike the Intel-chip theme that Altos has backed in all its previous systems, from Z80 to 8086, this machine uses the chip mentioned in its name – the Motorola 68000 – to provide minicomputer power, the minicomputer derived Unix III operating system, and mini-style plugs to drive remote terminals for up to 16 users in front of 16 video displays.

The really sly part of it, however, is the fact that it uses an operating system from Ryan-McFarland called COS 68000, which in turn lets people run software written in Ryan-McFarland's version of Cobol. Most Cobol lovers would probably rate RM Cobol a noticeable second to Micro Focus Cobol; that isn't the point.

The point is that RM Cobol is 'high compatible with' (that means very similar to) the version of Cobol that Texas Instruments has been supplying with its business systems for several years.

However, since the cost per system user on an Altos system is always very competitive with the cost per user on a minicomputer firm's machinery (eg, Texas Instruments) there will be lots of people selling TI equipment who will be able to cut the price of supplying a mini, and still make a bigger profit, by selling one of these Altos systems, rather than the Texas one, when their customers come back for a second system.

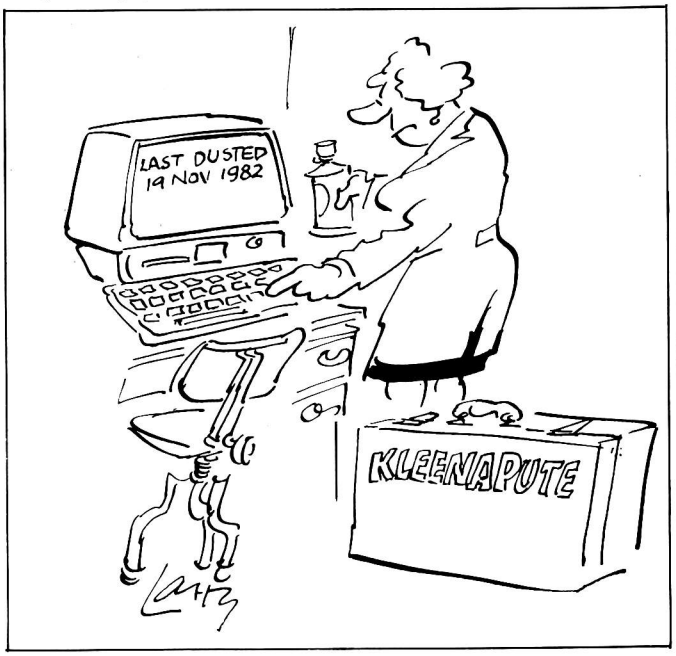
The price for a system with 20 Megabytes of hard disk starts at around £11,695 'with substantial discounts for quantity orders', says Altos. Contact Roger Llewellyn on (03446) 77911.

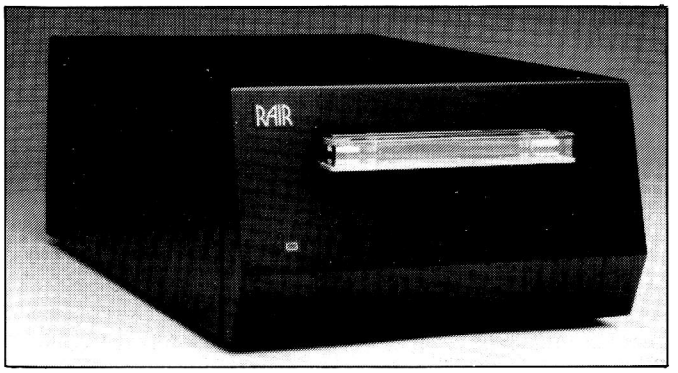
Stats of the art

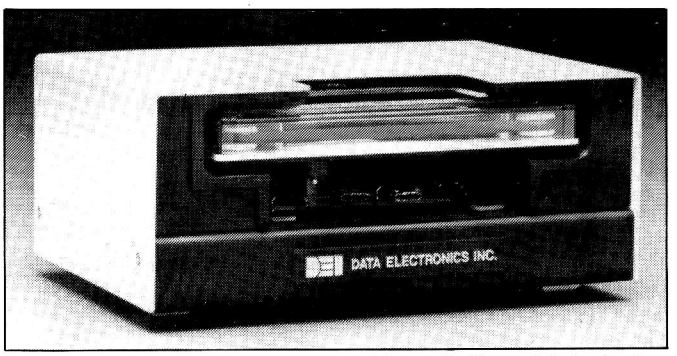
Statistics on the size of the micro business in the UK are hard to find: so it is worth repeating Commodore's claim of 1 February that 'over 80,000 business systems have been installed to date'.

In 1982, the company added, 110,000 VIC-20 computers had been bought by home computing enthusiasts.

The occasion of the announcement was an attempt to scotch a rumour that the company had started building a new factory. Not yet, said the announcement, but plans to put a Commodore factory into the UK are well advanced 'and the choice of site is totally dependent upon the level of Government grant available, and on the financial incentives which may be offered by Governmental institutions'.







The similarity of these two tape cartridge units lies solely in the fact that they both use tape cartridge to store the information held on a hard disk, and that the hard disk can get the information off again later, if it all gets lost.

The pretty one, from Rair, is meant to be put on the desk and connected to a hard disk system. It costs £1750 for a 10 Megabyte drive and £2250 for a 20 Megabyte drive.

The other, less obviously an office furniture item, will fit (says CPU Peripherals) exactly into a computer with a 5¼ inch disk drive, and is therefore meant to be bought by people who make computers and want to redesign them. Buy enough and each one could cost a mere £500.

Rair is on 01-836 6921; CPU is on Walton-on-Thames 46433.

Sheet skill

Computer printers often use a sheet of paper several hundred feet long, with perforations in it, for use at your convenience . . . but occasionally people want to print on ordinary paper with nice clean edges. Getting just one sheet of such paper into a daisywheel printer is a skill which usually eludes me. Getting a hundred, one after the other, is the sort of test of stamina which explains why all my copy is typed on continuous stationery.

ISA has come up with a little bit of metal and plastic which is designed to feed a whole stack of single sheets into a daisywheel printer, one after the other. The maker claims that the completely mechanical design needs no complex interfacing. Details on Bradford (0274) 497214.

Where are they?

Onyx, one of the first American firms to put the powerful 16-bit family of chips inside a personal computer, used the Zilog Z8000. Subsequently, the company added the even more powerful Motorola 68000 to the list of chips used in its machines.

When IBM instead chose the Intel 8086 family of processors, Onyx wasted little time in backing the same horse, by taking over Mercator, a company which already had an 8086-based design.

That went through in November last year; in

January, the UK distributor, Scan Computers, announced that it, too, would be selling the Mercator range. Company Chairman, Martin Baldwin, reckons that the deal he has done with Onyx will add 20 firms to the 40 who already sell hardware supplied by Scan.

The company says it is a surprise, so it must be. The surprising part of the announcement is presumably the fact that the joint venture between Scan and Mercator Business Systems Ltd (the UK subsidiary) will be based not at Scan's Storrington (Sussex) offices but in brand new offices in Manchester.

Which means that interested parties will be glad of the new address. So Scan, very thoughtfully, hasn't provided it. Ask the company for details on (09066) 5432, in Storrington and, with a little luck, by the time you read this, the people there will know the new phone number.

No noise

The Gould 'Mainstay' brand power supply is designed to provide noise-free electricity to micros.

The supplier says that the £65 (inc VAT) unit will clean up both noisy and fading power – it will provide full power even if the mains voltage drops to 75 percent of what it should be, and will also smooth out sudden spikes of power caused by such normal domestic events as the start of the washing-machine spin cycle, or the switching on of a Hoover, or an oven thermostat.

Details of the Mainstay are on (0978) 821000.

Coming soon

The one thing that The Forecaster is not, is a spreadsheet program, says software producer Microcomputer Program Design of Fife.

The program, which runs on Commodore 8032/8096, is described as 'the first expert forecasting system', capable of making predictions based on history.

Like a spreadsheet, it is filled in with basic figures such as monthly sales earnings, the price of raw materials, the quarterly fuel bill, and so on, but instead of having the user type in formulae to describe the relations between the numbers, the program does that itself.

It then asks how far into the future it should look, and selects an appropriate mathematical model that best fits the figures so far on which to calculate the likely future changes.

And, says MPD, it will give a 'confidence interval' for the forecast – that is, it will give a range of values inside which it is confident that (say) nine times out of 10 the true value will lie.

The price is £320 and details are available from the company at 2 Hillside Place, Newport-on-Tay, Fife, tel (0382) 645979.

Spreading fast

The five-fingered Microwriter keyboard which TV celebrity Dennis Norden can occasionally be seen plugging ('I've given up writing, and urge you to do the same') is looking to expand by trebling the number of centres where people can buy them.

The device can accept up to eight pages worth of one-handed typing, which can be transferred into a microcomputer later and edited with a word processor.

The Microwriter company says that the result is that many 'professional "thinker" writers' such as consultants, engineers, researchers and academics, are buying micros in order to process notes made with the Microwriter.

Now, with the announcement of backing from merchant banker Hambro, they are looking for places to expand. They are also looking for people to do it with them. 'Microwriting Centres can be set up with minimal investment in stock or staff,' says the company. However, 'to maintain a consistently high level of customer support and service, each Centre's personnel attend a two-day course.'

Interested people should contact the firm on 01-831 6801.

Pick 'n' choose

Anybody who asks what good one operating system is, compared with another, will fail to grasp the importance of an established favourite called Pick, which appeared last month on the Altos range, and this month on a low-cost imitation of the Honeywell-based Ultimate Computer.

The Ultimate is not normally the sort of machine that micro users waste time looking at after they catch sight of the price tag. But there are corporate customers who have bought and do use it, and who have written what they regard as good software to run under Pick.

These people can now down-load this software onto a Universal Computers Ltd machine called Epick, which uses an ordinary Z80 micro to run the Pick-based programs. If you want to get some measure of the difference in price scale, you might ponder on the managing director of UCL, Nick Drescher, who announced the £7500 system with some pride – not as an indication of its upmarket qualities but as proof of how cheap it was.

'The entry level to the Pick system and all its benefits is drastically reduced,' said Drescher, adding that the £7500 was the price they started 'from' before going up. It may sound costly to you and me, but for the man who has a £50,000 investment in his own software, I suppose it seems like peanuts.

Details on 01-231 7355.

16-bit CBasic

A flood of old software can be expected on Sirius and IBM family micros, now that Digital Research has produced a 16-bit version of its CBasic compiler.

The compiler will take Basic instructions written for either the old CP/M (the 8-bit version) or the new 16-bit CP/M-86 operating systems, and produce code which can be loaded directly into the processor's internal works.

The result, says Digital Research, is that any CBasic programs on old machines can now run on the new ones – and further, any CBasic programs

Epson UK has decided to pay Mariasela Alvarez Lebron (Miss World) a lot of money because people like taking pictures of unusually pretty girls, and some of the resulting pictures will include Epson products or executives.

Since Epson marketing boss John Patterson appears in this picture, it seems safe to presume he wanted publicity.

You may care to speculate on the process of tact, then, which prompted the company to explain that, in future, 'there will be more emphasis placed on mental abilities' in the Miss World contest, since in future, Epson will 'be figuring very heavily in the actual finals, featuring staff on the judging panels, and setting an Epson technology test to assess entrants'.

Warning!

Just as this issue was about to go to press we received the following urgent letter from Sinclair Research managing director Nigel Searle:

We need urgently to contact a number of our customers who have purchased, or received as a replacement, a Sinclair ZX Spectrum computer, since 1 January 1983.

Anyone in this category should *immediately* check their power supply/mains adaptor. We believe that a batch from one of our suppliers is faulty and, in certain circumstances, might conceivably prove dangerous.

The batch is limited in number and easily recognised.

If, and only if, the lead between supply and the Spectrum is black with a *white* stripe, then:

1) Switch off at the mains, disconnect the system, and remove the plug from the power supply.

2) Pack the power supply and post it to Sinclair Research Limited, Unit F, Broad Lane, Cottenham, Cambs, CB4 4SW.

The computer itself is perfectly safe and should not be returned.

We will be replacing the power supply as soon as possible, and would like to apologise to any of our customers affected for the inconvenience caused.

Finally could I reassure all our customers that the problem is restricted to a limited number of Spectrums and affects none of our other products.

Nigel Searle,
Sinclair Research Limited

written for the new ones already will now run five times faster.

The 8-bit programs will require 'little or no additional programming', according to Digital Research's European boss, Paul Bailey.

Similarly, the language PL/I is now available for 16-bit micros of the IBM and Sirius variety, as is Pascal/MT+.

Details of all these on (0635) 35304 in Newbury.

At last. . .

After keeping the world waiting since April last year for its new machine, Commodore has finally launched it.

It is called the Series 700, and the company produced it with what one might describe as adequate fanfare – 154 of its British dealers went out on a couple of days in February and ran two-day seminars in major hotels around the country.

The cost of the campaign over and above the £100,000 spent on advertising it was considerable and explained not just by the delay but by the publicity generated for rivals Digital Equipment, IBM and Apple who all launched exciting new machines recently.

News will now start filtering in from the first few users, who are anxiously waiting to see how much of their old Commodore software will run on the new machine.

First reports, very sketchy, indicate that a fair amount of work is needed on most complex programs – but that relatively simple ones can be transferred a lot easier. Now, maybe, Commodore will get round to letting *PCW* Benchtest one – but don't bet on it.

Watch this space.

Micro scare

There are lots of ways of becoming scared of micros, and a new one has been invented by American research company IRD (International Resource Development) which is afraid that we will all believe computer output simply because a computer produced it.

A massive 265 page report asserts that 'because these programs (spreadsheets and schedulers) produce highly-polished output, at least in terms of appearance, they can easily give the impression that the level of assurance surrounding the projection is far greater than in reality'.

The researcher behind the report, one David Ledecky, has noted that people tend to believe the printed word. 'Just as we tend to believe everything we read in the newspapers, we also tend to believe everything that computers tell us,' he explains.

It's an interesting thought, not to be dismissed too readily, but flawed by the simple problem of trying to establish what people really believe.

Certainly, if one produces a set of figures with Visicalc, showing profit and loss projections for a new enterprise, and they are all interrelated, and cross-check, it is hard to convince yourself there might be something wrong with them.

But the question of whether people go ahead with new business ventures with the encouragement of Visicalc when they might have abandoned the idea without it is like trying to place bets on which horse would have won if the horse that did win had fallen over on the first bend.

The report is valuable for analysing the way micros are being bought, who is buying them and what they are doing with them.

An old hand at computers, however, might regard the observation that spreadsheets are no cleverer than the information fed into them as a restatementof the old Garbage In, Garbage Out (GIGO) cliche. It's true, but not much help at deciding whether the input was, or was not, garbage.

Still, the fact that people all take printed matter seriously will console IDG, who have written all this philosophy down in black and white, and hope to get nearly $1000 per copy.

If you believe everything you read, rush your order to them at 30 High Street, Norwalk CT 06851, USA.

Seiko 8600

According to one of its US distributors, 'the Seiko 8600 Personal Computer will make the Apple II look like the Timex-Sinclair of the industry'.

While this could turn out to be the case, such enthusiasm masks the fact that the above-mentioned machines are all designed for very different types of users — and for those with quite different-sized wallets.

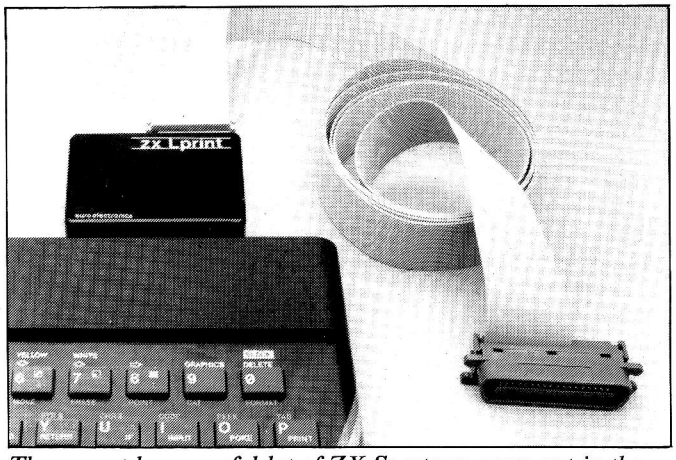
The Timex-Sinclair machine can still provide the beginner with a fair order of computer experience (the

These two obviously have a lot to smile about. Teenage tycoon Richard Branson (he's the one on the right with the beard, and the vegetation climbing up his jumper) is further extending his plans for world domination by setting up yet another subsidiary, Virgin Games Ltd. This will concentrate on software for a wide range of home computers — Atari, BBC, Commodore 64, VIC-20, Dragon, Oric, ZX Spectrum and TI 99/4A.

Virgin Games will be headed by Nick Alexander (the other smiler in the photograph), who was responsible for UK and US software for Thorn/EMI.

Alexander says 'There are already 750,000 home computers in Britain — well over three times what there was a year ago. The industry expects growth in 1983 to be even more dramatic and at this rate it will not be long before the computer software market is bigger than that for the video cassette.'

Programmers who have written 'exciting games with good graphics and original themes' are invited to contact Virgin Games at 61/63 Portobello Road, London W11. Good royalties are promised.



There must be an awful lot of ZX Spectrum users out in the big wide world who'd appreciate this one. A Centronics interface for the Spectrum which allows it to drive a wide variety of dot matrix or daisywheel printers is what can only be termed a boon.

This smart little module is exactly that. It allows the Spectrum to print to any compatible printer's maximum line width and it clips tidily into the back of the machine through the ZX Printer connector.

The ZX LPRINT even caters for printers requiring special control codes and separate software on cassette allows screen dumps of high resolution graphics. LPRINT and LLIST commands, though, require just the ZX LPRINT interface to be plugged in.

It'll be priced at just under £30 and will probably be available by mail order.

Sounds useful/just what you need? Details if so from Euro Electronics on 0242 582009.

price can be as low as $70 if you know where to look), while the venerable Apple II, now living in the shadow of the smooth Apple IIe, is probably best left out of comparisons, both machines are inexpensive single user systems. Not so the new Seiko product.

Based around a 16 bit Intel 8086 chip running at 5 MHz, the Seiko 8600 range is being pitched at those of us who would like to be multi-users.

There is more than enough multi-user software from the company to make such a thing posible — MP/M-86, Oasis, a version of Unix system III called Unidol, and MBOS Multi-user Basic Operating System. If you are really determined to remain a single user Seiko provides the now-expected CP/M-86 and MS-DOS combination as well (or you can buy an Epson single user system since Seiko makes these as well).

Languages initially on offer are Basic, Fortran, C, Pascal, Cobol, and assembler.

In terms of price, things don't truly begin to look sensible until two to four users are involved, since the standard 128k machine with one 640k floppy drive, five I/O ports and an 8086-driven video terminal would set you back about $5400. Operating system software costs extra. However, a three-user system with 256k memory, one 640k drive, a 10mb hard disk, five I/O ports, and the Mbos operating system costs $12900.

The self-diagnostic capabilities are included on both the CPU and video terminal and, if the company is to be believed, the main unit can be taken apart by the skilful application of an index finger to a set of plastic interlocks or catches, which hold the whole thing together.

Lots of CP/M, Unix, and MS-DOS software packages are currently being ported over to the 8600 by dealers, many of which have been given a special brushed aluminium version of their machine to entice customers in. Normally, it comes in off-white plastic and is styled rather like a video recorder.

Plans are being made for a bigger system based on the yet to be commercially used Intel 8286 chip; this should be able to keep between 12 and 16 users happy at one time.

There is no indication of when the 8600 will appear in the UK, since Seiko says it wants to make sure of the US market first.

Robin Webster

Your very own chips

Did you realise that you own a chip manufacturing company? Or, to be accurate, a very small part of a chip manufacturing company. Inmos is what it's called and it was set up with huge amounts of the taxpayer's money to kick Britain into the Silicon Age.

Well, Inmos has just announced that we can buy its first UK-produced 64k dynamic RAM chips, produced in the company's factory in somewhere unpronouncable in Wales.

Hi-res on Sirius

We all know how marvellous the graphics facilities are on the Sirius, don't we? Marvellous in theory, that is, but when the first machines appeared on the market there was simply no way to use them — unless you were content merely to sit and watch the very spectacular high-resolution demo program which cheekily crammed four standard Apple demo pics onto the same screen.

Now Georgetown Computer Services has launched a graphics pack to allow you to get to grips with the Sirius. It provides facilities for drawing graphs, histograms and pie charts which you can store on disk and load in again either singly or merged. The program links up with Supercalc and with your own software and, says the company, a Micromodeller link is 'being researched'. More on 0235 817927.

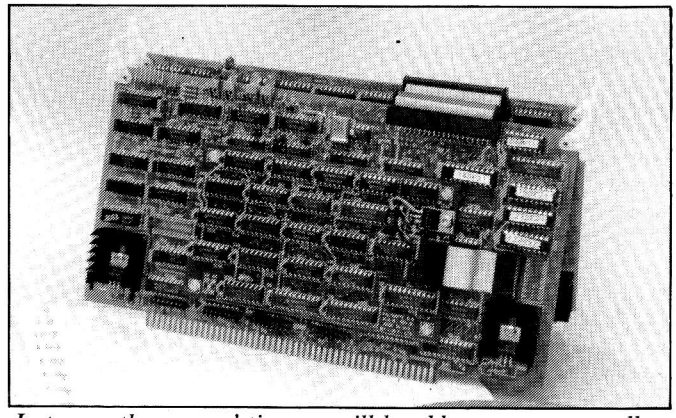
Peter Rodwell

Faster, smaller

Dataview has produced a version of its DTL-Basic compiler for the Commodore 64. It's available on both tape and disk (and is the only one so available, claims Dataview) and is 100 percent compatible with the machine's Basic interpreter. The compiled programs run up to 25 percent faster than interpreted equivalent and are up to 80 percent smaller than their uncompiled versions.

Dataview has also produced the compiler for the Commodore 500 and 700 series machines, the new ones launched a year ago and still not available (at least we can't persuade Commodore's PR people to let us Benchtest one). Under what Dataview describes as 'ideal conditions' (but it refrains from detailing what these might be), this version of the compiler gives programs which run up to 55 times faster than compiled stuff. Find out more on 0206 869414.

Peter Rodwell



In two or three years' time we will be able to connect up all our micros to each other using the Ethernet system, the interface for which will, by that time, consist of a handful of chips.

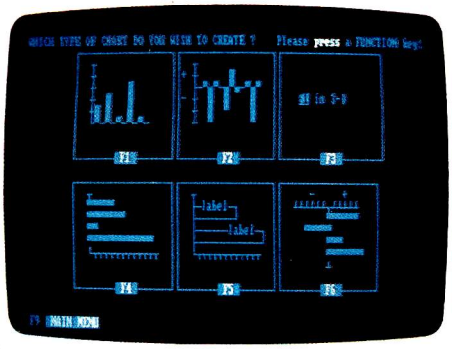
At the moment, though, you need considerably more than a handful to be Ethernetted; if you really can't wait, and have an S100 system, then this set of boards from Sintrom Electronics is what you want.

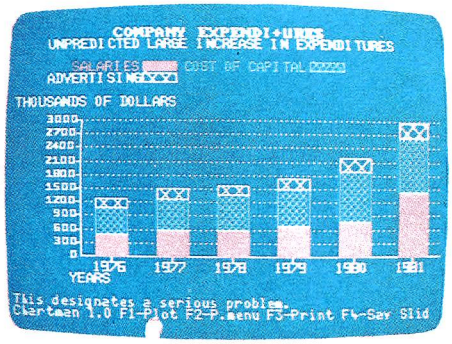
As well as supplying the hardware, Sintrom includes software for CP/M and TurbosDOS systems to give electronic mail and file serving capabilities.

Contact Sintrom on 0734 875464.

CHARTMAN is here!

BONSAI BRINGS YOU THE LEADING BUSINESS GRAPHICS SOFTWARE for the IBM Personal Computer.





CHARTMAN brings out the messages buried in piles of data by turning columns of numbers into quickly and easily understood graphics. CHARTMAN will produce top quality horizontal and vertical Bar Charts, 2- and 3- dimensional Pie Charts, linear and logarithmic Line Charts, text pages and signs. You can display them on screen, print them on a graphics printer, and plot them onto paper or acetate transparencies.

CHARTMAN is a really easy-to-use, menu-driven program that allows you to produce presentation quality graphics immediately with little or no training. You either enter data through simple fill-in-the-blanks screen layouts, or interchange rows or columns with programs like Visicalc, MicroPlan ver 4, TK!Solver, and many others that support DIF.

CHARTMAN was designed specifically for the IBM Personal Computer to utilise its powerful features. Once charts have been created, they can be stored, then retrieved and edited later. CHARTMAN even has a slide presentation feature where charts can be saved as slides for a manually stepped or automatically timed "slide show" on the screen.

CHARTMAN I: displays everything on the screen in monochrome high resolution, prints charts on the IBM Personal Computer printer or Epson MX80 and 100 printers (all need the Epson Graftrax option), and can plot on HP7470 2-pen and HP7220 8-pen plotters. ***£295***

CHARTMAN II: in addition to all the features of CHARTMAN I, CHARTMAN II can display charts in colour on RGB monitors, can print colour charts on IDS Prism colour printers, and can plot on IBM XY750 plotters. ***£395***

Give Bonsai a ring, or cut the coupon, to order your copy of CHARTMAN, to receive further information, or to arrange a demonstration of CHARTMAN on the IBM Personal Computer at our London showrooms.

IBM Authorised Dealer—IBM Personal Computer

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WATCH OUT FOR YOUR PROTOCOLS!

In the final part of his series on networks, Terry Lang delves into rings before getting down to the software which makes networks work.

This article is the third, and last, in a short series on the subject of networking. The first article discussed the basic characteristics of a network, and looked at a simple 'star' network with just one central controlling switch or 'node'. The second article discussed networks which switch 'packets' through a mesh of interconnected nodes. The present article will first describe the basic features of 'ring' and 'broadcast' networks, and then bring the series to a conclusion by looking at the all-important software requirements.

Round the circle line

Suppose we have to provide for the networking requirements of one large site (industrial, administrative, or research laboratories, or perhaps a mixture), possibly with a number of separate buildings. The networking requirements on this site may include the interconnection of a central computing facility with distributed mini and micro word processor systems and numerous terminals. (We will assume, at least for the moment, that there are few off-site connections, and that these are adequately catered for by some public carrier service, probably of the distributed packet switched type.)

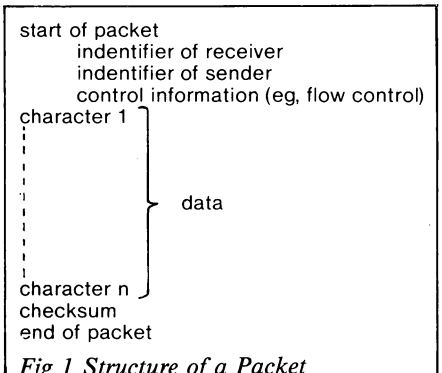


Fig 1 Structure of a Packet

If we return for a moment to the 'star' network with the central node which we considered in the first article, we can see two major disadvantages for our posited situation:

— much cable would be needed to connect every point of service to the central node (especially between buildings on a large site);

— a central node would have to work extremely hard to deal with our maximum total communication rates, possibly in excess of 10 Megabaud.

A way round the first of these problems is to provide for just one cable which threads its way through each point of service in turn. Suppose we wish to pass packets of information along this cable. (The structure of a packet is illustrated in Figure 1; the *raison d'etre* for using packets was discussed in the previous article.)

If we are to pass the packets extremely quickly, then we will have to relax the restriction that before a node can send a packet along the next link of its journey it must wait until it has itself received and checked the whole packet. Rather we shall get maximum speed by allowing nodes whenever possible to pass on each individual *bit* as soon as it has been received. Finally, if a packet passing along this cable is to be able to reach any receiver from any sender, then we can provide for this by connecting the end of the cable round to its beginning, thus forming a complete ring, as illustrated in Figure 2. (Pioneer work on this configuration was carried out at the University of Cambridge, and so the term 'Cambridge Ring' is often used, in either a generic or a specific sense.)

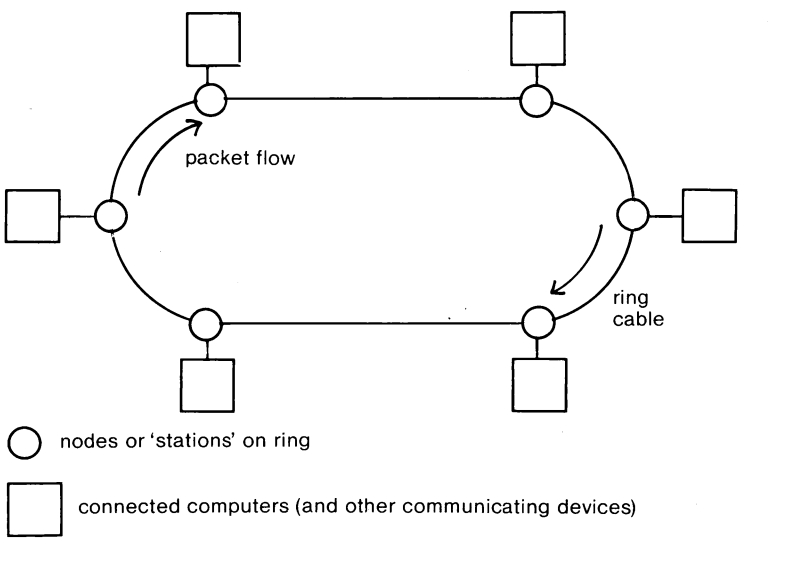


Fig 2 A 'Ring' network

As indicated above, a node on the ring will whenever possible pass on every part of the packet as soon as it is received. When the identifier (or 'address') of the receiver has arrived, then the node can decide whether the rest of the packet is in fact addressed to itself. If it is not, then the node can simply keep the rest of the packet moving as quickly as possible. If the node is the intended destination, however, it can take a copy of the data in the packet and pass this out to its connected computer (or peripheral of any kind). At the same time the node will also continue to pass on the packet, so that it can complete its cycle back to the original sender.

As the end of the packet is reached, the receiving node can insert a marker to indicate to the sender whether or not the message was correctly received (ie, the checksum matched). When the packet completes its cycle round the ring, the sender can check this marker to discover whether or not the packet successfully reached the receiver.

Because very high quality cable is used (eg, shielded twisted pairs, coaxial, or optic fibre) together with ultra-reliable node hardware, then very low error rates will be expected (eg, an error rate of 1 in ever 10^{11} bits might correspond to one error in every three hours of operation): the error checking mechanism can be designed appropriately. Typically packets are very small, eg, just two characters of data. This makes them more suitable for working with individual terminals in full duplex mode — see the discussion on 'packet assemblers/disassemblers' in the previous article.

When a packet completes its journey round the ring, the sender extracts it, and replaces it with an 'empty' packet, which will continue to circulate until picked up and used by another sender. Of course, the

Illustration by Kevin O'Keefe

WATCH OUT FOR YOUR PROTOCOLS!

original sender might well have further packets ready to send, especially if it needs to make up one long packet (eg, 512 characters) out of many 'mini packets' (of two characters).

However, if the sender immediately sends round again the packet which has just completed the cycle, then all the other nodes on the ring will be prevented from transmitting, because all they will see passing is 'full' packets. Therefore a rule is imposed within the system whereby a sender can not retain use of a packet it has just cycled, but must pass it on as an empty packet, so that a node downstream is first given the opportunity to transmit. (There is an alternative mechanism which can be used on rings which employ very large packets. In this case what is sent round the ring initially is a small 'token' packet. The node which holds the token may then transmit a large packet, or alternatively pass the token on. This approach is particularly useful for 'synchronous' transmission, where the whole of a large packet has to be transmitted within some guaranteed time interval.)

In summary, then, the ring architecture provides a convenient approach to minimising the cable required. It also provides very straightforward mechanisms for routing (ie, a node either extracts a copy of a packet or simply sends it on) and for flow control (ie, via the 'empty packet' or via a 'token'). On the debit side, there must be concern about the reliability of the system, since the 'ring' is in effect common to all nodes, and one node fault or one cable fault could prevent the whole system operating. In practice, however, this does not turn out to be such a great problem. The node hardware is designed to be ultra-reliable. The node circuitry is kept distinct from the computer or peripheral interfaces connected to it, and DC power for the nodes can be distributed via the ring cable.

Generally a ring includes one special node, which is responsible for starting up the empty packet (except in 'long' rings, there will be just one packet circulating), and for monitoring the occurrence of errors. A break in service must be made when it is necessary to open the ring and insert a new node, but this can at least take place at an advertised time.

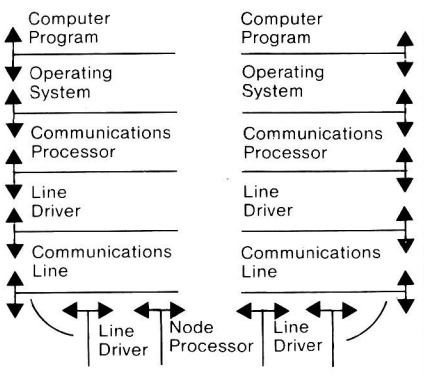


Fig 3 Hardware and software interfaces on path between two computer programs conversing using a Protocol.

The data rate on ring networks is typically between 1 Mbaud and 10 Mbaud. To ensure no significant waiting time before a node receives an empty packet and can send information, the average level of utilisation must, as demanded by queuing theory, be significantly below this level. In one large automated-office type of environment, short term average loads of around 35 percent were found at peak periods, with a 24-hour average of only a few percent.

Is there anyone out there listening?

The previous section described how the 'ring' architecture was evolved to meet the local area network needs of an organisation. There is, however, another approach to the problem of minimising the amount of cable required, and that is to start from the position of using no cable at all. This could be achieved simply by equipping every node with a CB style radio. Any node that wants to send a packet simply broadcasts it, including as usual the identity of the intended receiver at the start of the packet. All the radios broadcast on the same carrier frequency, and all nodes maintain a listening watch on that frequency. Thus, when the packet is broadcast the receiver will be expected to recognise its own identifier and to record and act on the rest of the message. (Of course this is hardly the most private means of sending messages, and any encryption has to be carried out privately in the sending and receiving nodes. The same considerations will also apply to ring networks.)

We also have to consider the situation where several nodes wish to transmit at the same time. The rule is simply that any node which wishes to broadcast must first listen to make sure that no one else is broadcasting (ie, there is no carrier signal being broadcast over the 'ether'). If necessary, a node must simply wait for the transmission in progress to finish. Of course there is still a small chance that two nodes will start to broadcast simultaneously (particularly if both have been waiting for some other node to finish). To overcome this, nodes must continue to 'listen' to the ether even while they are broadcasting. If interference is detected, then it can be inferred that a 'collision' of packets has taken place.

In such a case both transmitting nodes must stop their broadcsts. If they both restarted immediately then they would of course simply collide again, so what actually happens is that both wait for a 'random' time and then try again. Most frequently one will then start again before the other (on a random basis) and the second will simply wait its turn when it hears the carrier of the first. (Should both collide yet again then they simply wait once more. Provided the 'random' wait is indeed random then one of the two will eventually get started first.)

This approach to networking was first developed by Xerox, and is usually known

as Ethernet (again in both the specific and the generic sense). Sometimes it is also called 'CSMA/CD' which stands for Carrier-Sensing Multiple-Access with Collision Detection. In actual fact the use of radio would be prone to interference, and to provide very low error rates with very high transmission speeds the 'ether' is replaced by a high quality cable which connects every node in turn. In this respect it is similar to a ring system, but of course in this instance the ring is not closed, and the cable acts as a system 'bus'.

Also, if there is no transmission then the cable is quiescent and there are then no circulating packets. (As an alternative to the collision detection approach described above, the passing of a 'token' to give successive nodes permission to transmit can also be used on broadcast networks as well as on ring networks.)

Insofar as there is the one common cable or 'ether', considerations of reliability are similar to those of a ring. However, nodes which fail in a passive sense (eg, go right off-line) do not cause a network failure. Also, with suitable design, it may be possible to add nodes to or remove nodes from the cable with no disturbance in service. But a node which failed in a way which generated continuous carrier, or which short-circuited the 'ether' would still bring down the whole network. Depending on the actual transmission techniques used (eg, over twisted pairs, coaxial or optic fibre cables) there is a limit to the maximum length of cable, even with repeaters, because transmission delays can start to interfere with the collision detection mechanism. (In a ring system every node automatically acts as a repeater.)

Finally, in contrasting the distributed packet switched network described in the previous article with the ring or ethernet approach, we should note that the distributed 'wide area' network includes extensive error checking and recovery procedures across every link in the journey of a packet, whilst the 'local area' networks take advantage of high quality cable and shorter journeys to leave checking and recovery just to the sender and receiver at the ends of the journey.

Can I plug it in now?

That concludes our review of some of the major networking techniques. To us as end-users, network will present itself simply (at

first sight) as a socket into which we can plug our computer or our peripheral. When viewed in this way, it doesn't matter too much exactly which of our network architectures lies behind the plug, provided that our criteria for good networking are satisfied (as described in the first article in the series). That being so, we may be anxious to plug in and start working. However, anyone with any experience of plugging together any two pieces of equipment from different manufacturers will realise that there is still plenty to go wrong at this stage. In particular we have as yet paid little attention to the all-important question of the software which we will need to access the network.

If we are to be able to plug a whole range of computers and devices into our network, then we must first agree on:

a) The physical standards of the plug, particularly the number and configuration of pins and their relationship to the cable;

b) The electrical signal levels (currents, impedances, transition times, etc) to be applied at each pin;

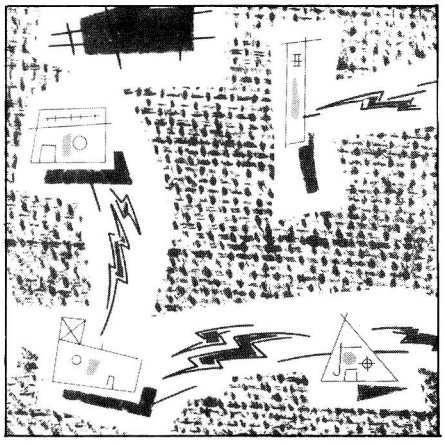
c) The way these signals are to be interpreted to define the flow of information — both the data itself and the control signals which go with it.

These three definitions taken together are what constitutes an 'interface'.

However, as users we do not want our computer (or other device) to converse simply with a plug, but rather with some other computer or peripheral on the other side of the network. Here we have deliberately used the word 'converse', to imply firstly two-way conversation (in the general case), and secondly the ability to support complex or 'rich' dialogues. Therefore we must also agree on the rules by which a conversation is to be conducted. There is a strong analogy with the rules (both technical and social) underlying an ordinary telephone call between individuals A and B:

— A dials to establish the call;
— B answers, identifies himself;
— A identifies himself, announces topic;
— B replies; A and B then talk alternately, until first one and then the other say goodbye;
— both A and B then hang up, breaking the call.

We also saw in the previous article how A and B have additional rules for dealing with noise on the line, a disconnected line, the call not getting through, etc. The equivalent set of rules for conducting a conversation between computer programs/



equipment is called a 'protocol'. The end-to-end link between the parties is made up of a series of 'interfaces', and the information passing according to the rules of the protocol passes through the interfaces. This is illustrated in Figure 3.

As implied in our analogy, a protocol has to fulfil several functions:

1) The 'high level' exchange of information between two **applications programs** to give effect to the user's requirements — eg, office automation activities, or the processing of a job on one computer as submitted from another.

2) The agreed common coding or **presentation** of data necessary to carry out the processing of level 1 — eg, the coding of document contents for word processing, including margin settings, paragraph breaks, page headings, etc.

3) The way in which a full conversational **session** or dialogue is to be carried out when commands and data are exchanged — eg, how a call is to be established, how the two sides of the dialogue are to be synchronised, how to deal with an apparently disconnected call, etc.

4) The **transport** of information from one end of the call to the other, dealing with such information as the relation between the identifiers or 'addresses' of the sender and receiver in terms of the network, the 'flow control' limiting the amount of data in transit at any one instant, the buffering or blocking of data segments.

5) The requirements of the **network** level itself — eg, routing, error detection and recovery, maintenance of packet sequence

6) The transmission of data across individual **data links,** providing flow control, error recovery, etc, for each link (ie, for all the 'calls' which may be sharing the same link).

7) The **physical** communication of information from end to end of a single link.

What we have listed here are the seven levels or layers of protocol as currently proposed by the International Standards Organisation. These layers range from level 1, the top level nearest to the requirements of the end user, down to level 7, the physical requirements most intimate to the internal workings of the network itself. Each layer of protocol provides a means of communication between equivalent parts of the system responsible for providing the same function. Each layer utilises the level immediately beneath it in order to build up its own services, and in turn provides these services to the level immediately above. Thus Figure 3 can be redrawn, with the emphasis not on the physical interfaces but rather on the protocol layers; this is shown as Figure 4.

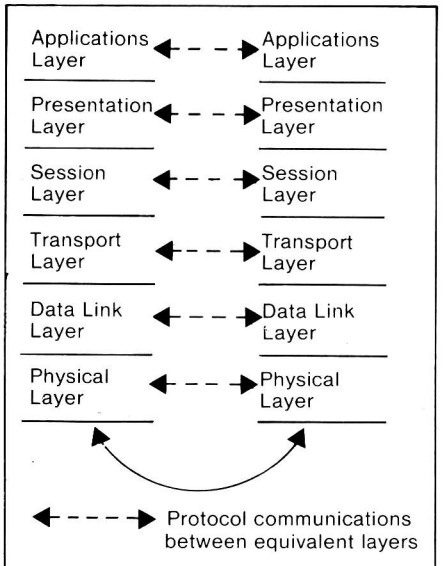


Fig 4 Use of Protocols to provide services at various levels across a network.

Where do we go from here?

Evidently the networking scene is going to remain in a considerable state of ferment for some time. The continuing development of electronic/computing technology is going to open new opportunities. While we have discussed in these articles some of the emerging network techniques, the relationship between these and the related developments in digital telephone exchanges and in cable television networks is as yet by no means clear. Just as for the hardware, the internationally agreed protocols are also going to take some time to merge in anything like their final form.

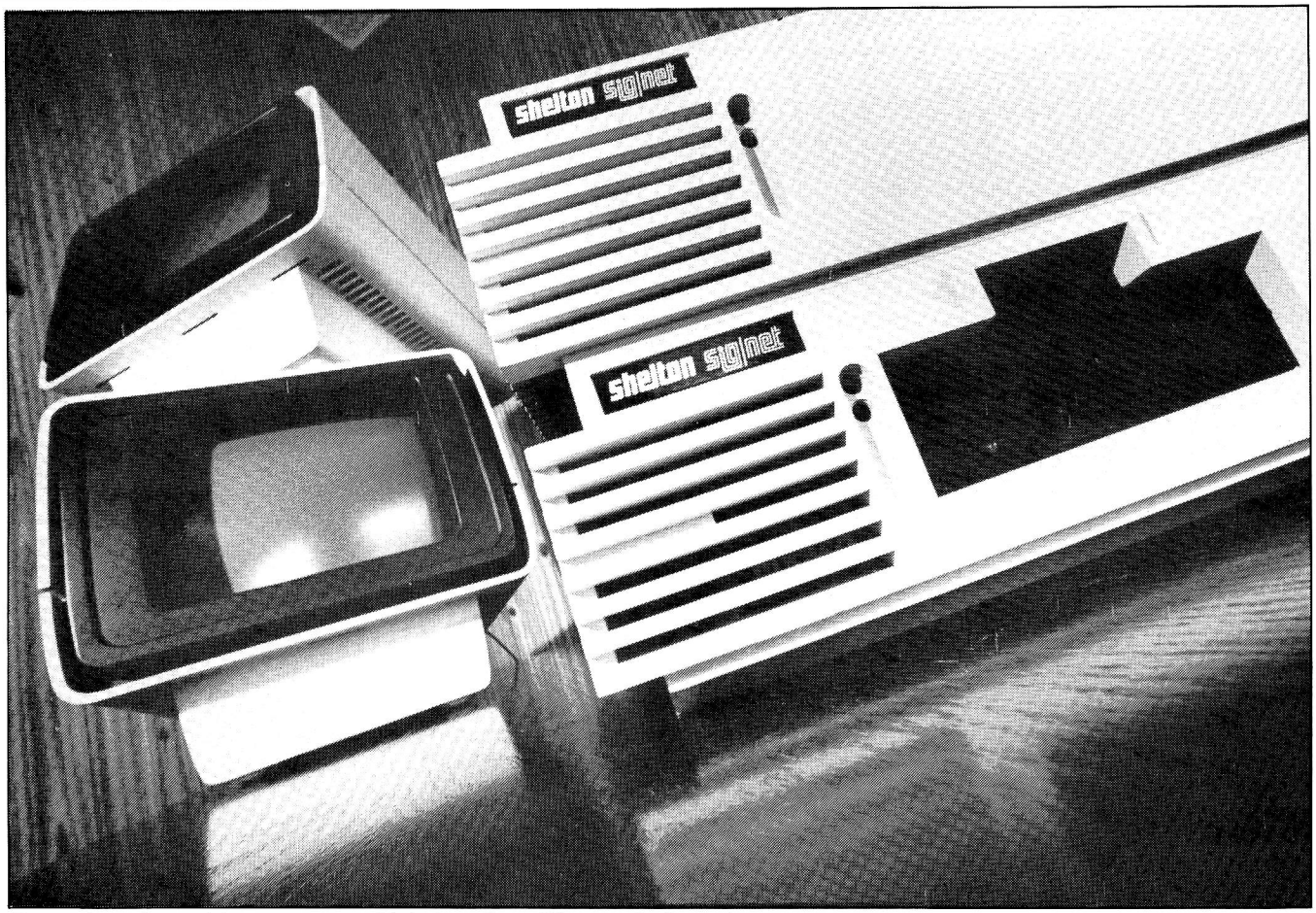
For users who need to purchase network facilities now, a number of systems using the techniques described in these articles are already available. Specific proposals should be judged not against the esoterics of network jargon, but on the way they will actually meet the current and perceived future end-user requirements (perhaps using the criteria discussed in the first article).

A major problem for the user is to try to gauge how a product will fare in relation to the future developments in network technology and protocol standards. It is at least a good sign if the system is implemented in modular fashion, with clearly defined interfaces and protocol layers. This should give maximum facility for upgrading or replacing parts or layers of the system as opportunity arises or need dictates. If the protocols are based on the latest thinking in probable or potential standard protocols, then future disruption should be minimised, and connections ('gateways') to later networks made with greater ease.

If we assume that the technology is going to come together, then the most important question of all is not just what it can do for us as computer users, but rather in what way we should direct the opportunities it offers in order to bring maximum benefit to society.

Various bodies with international membership have been working for some time to reach agreements on the protocols and on the interfaces involved. While the degree of agreement so far reached is, like the proverbial curate's egg, 'good in parts', it is at least heartening to contrast the current enthusiasm for general Open System Interconnection with the more defensive and parochial attitudes previously seen in some quarters during the early mainframe days.

END



Front view of a multi-user system with hub and satellites stacked together.

A PIECE OF THE ACTION

Terry Lang investigates the benefits — and drawbacks — of a shared access system from Shelton Instruments.

THE MULTI-USER SIG/NET

In building their phenomenal success, microcomputers have had the advantage of needing only to provide an operating system which supports just a single user. This has enabled them to avoid much of the dead weight which encumbers mainframe systems. However, there has always been a need for micro systems to support a small number of simultaneous users — for example in neighbouring offices in a small business. (Such users will always need to share access to common data for business purposes. Sometimes users choose to share peripherals — eg, hard disks or printers — simply to save money, but the economic reasons for this latter type of sharing are likely to weaken as the technology continues to develop.)

Even in a shared microcomputer system, it has generally been economic to provide a separate processor for each user, and thus the spirit of simplicity in the operating system can be maintained. Nonetheless, the administration of the shared data does impose an additional challenge, and it is always interesting to see how this challenge is met.

In this article I will be looking at the way this is tackled by the Sig/net system produced by Shelton Instruments Ltd in North London. During a previous incarnation I was responsible for buying a large number of single-user Sig/net systems, which met all my expectations at that time, and I was keen to see how the multi-user combination would be carried through.

Hardware

The original single-user Sig/net is itself based on a ribbon-cable bus which connects together the internal components of Z80 processor and memory board, disk controller board, and communications boards (serial and/or parallel). In developing a multi-user system it was therefore a natural step to extend the bus cable to simply chain on other systems, each supporting a single user by means of a processor and memory board. This is illustrated in Figure 1.

The central or 'hub' system with one floppy disk and one hard disk fits in a case of its own. The satellite user systems fit three to a case, and these cases are designed to stack neatly with the 'hub' as shown

As many satellite cases as may be needed can be chained on via the bus cable. (I understand a 14-user system is the largest installed so far.)

The basic component boards, with the exception of the new ring-ring bus connector,

are all those which have proved very reliable in the original single-user system. (Since the company has a considerable background in process control, reliability should be something it appreciates.) To my mind the cases do run rather hot, but I am told this has not caused problems.

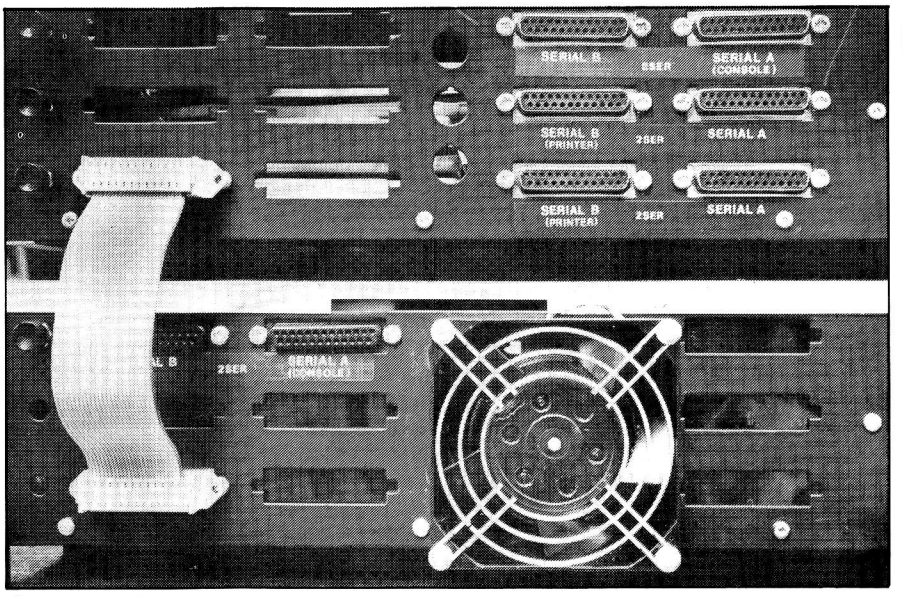
The bus cable runs at a maximum speed somewhat below 1 MHz, not particularly fast but adequate for the purpose, as I shall discuss below. More significantly, it has a maximum length of only a few feet. This is sufficient for stacking the cases as illustrated in the photographs, but does mean that all the processors and disks have to be sited in the same room. Of course the user terminals are connected via standard RS232 serial communications ports, and can thus be located wherever required (using line drivers or modems for the longer distances).

Alternatively, it is also possible to connect a complete satellite to the hub via an RS232 link. This would enable a satellite with its own floppy disk to be placed alongside a user and distant from the hub hardware, but it would mean that access to the files on the hub would be correspondingly slower.

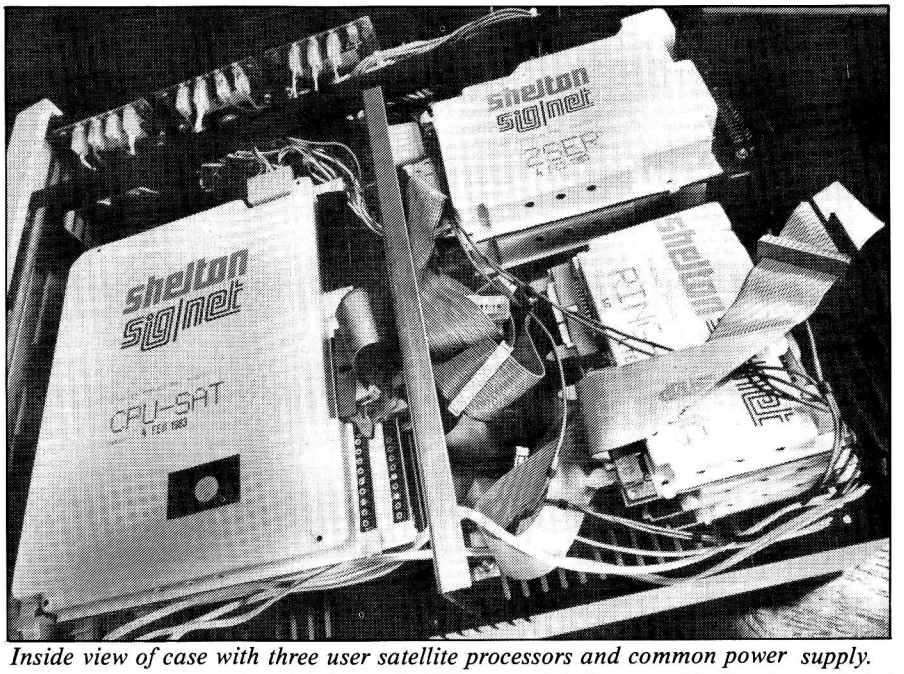
Both the hub and the user satellites use Z80A processors running at 4MHz. For the purposes of the standard *PCW* Benchmark programs, which are entirely processor-bound and make no reference at all to disks, it didn't matter at all that a multi-user system was involved, since each Benchmark program ran in its own satellite processor plus RAM board, unaffected by the rest of the system. The Benchmark times, with the programs written in MicroSoft Interpretive Basic, are given in Figure 2.

These times are as good as one would expect from an equivalent single-user system, and illustrate the benefits (or perhaps one should say the lack of drawbacks) of this kind of multi-user sharing. (Of course, where user satellites share access to the common hub filestore, then the user programs will slow each other down — this is discussed in detail below.)

The one-off end-user prices for multi-user and single-user Sig/net systems are given in



Rear view of multi-user system showing ribbon bus cable and terminal and printer ports.



Inside view of case with three user satellite processors and common power supply.

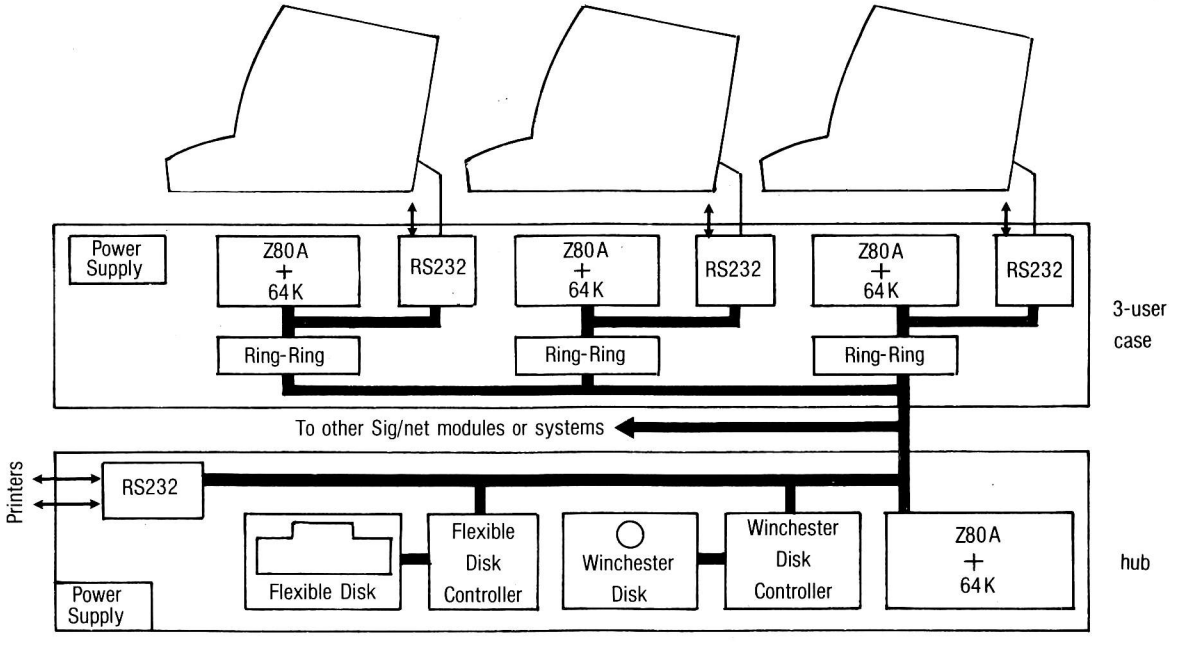


Fig 1 Modules making up the 'hub' and user satellite processors on a multi-user system.

Photography by Tony Sleep

A PIECE OF THE ACTION

Figure 7. These represent very reasonable value for money. Much of the system is of British manufacture or assembly, which should help price stability. It should be emphasised that in addition to the prices quoted you would require an additional terminal for each user. (Integral screens and keyboards are of course not appropriate to this configuration of centralised hardware. This does permit a range of terminal choice according to need.)

An important feature is the ease with which a single-user system can be upgraded to multi-user. The old single-user system simply becomes the hub, with one of the floppy disk drives exchanged for a hard disk. Multi-user satellites are then added as required. If you find a dealer who will give you a reasonable trade-in on the exchanged floppy, then the upgraded system should cost you the same as if you went multi-user straight from the start — a cost-effective upgrade path. Since a satellite case and power supply can be shared between three users, it is most cost-effective to add three users at a time, for a cost of £622 per user (plus terminals, of course).

For those who need such things, other peripheral hardware is also available — eg, graphics drivers, A/D converters, industrial I/O, S100 bus adaptor.

Sharing a hard disk

So much for a single user accessing one file over the McNOS network. As the next step, I looked at the facilities for several users to access different files on one hard disk. McNOS provides for separate users to be identified by distinct system 'user names', and each user name is protected by its own password. All files remain private to their owner unless explicitly made public via the appropriate command.

Each user name is provided with both a main directory and with up to 16 sub-directories (just as if the user had 16 separate floppy disk drives) identified by the letters A to P. Thus instead of the traditional CP/M prompt of the form

A>

where A identifies the logged disk drive, in McNOS this becomes

A.C>

where A identifies the hard disk drive and C the default sub-directory for this user. Whenever the user creates a new file, space for this is taken from wherever it can be found on the drive. Some multi-user systems divide the hard disk up in advance, so that each user has a fixed allocation, but whilst this protects other users against an ill-mannered user grabbing more than his share of space, it also means that space allocation has to be fixed in advance. In a well-ordered community, the McNOS approach is much more flexible.

To measure the effect of sharing the one disk, I repeated my Benchmark, with a different file on the hard disk for each of two users. When I ran the program for just one user alone, the execution time was 33 seconds; when I did the same for the second user alone, the time was 54 seconds. This very large difference was due to the different positions of the two files on the disk, thus requiring different amounts of head movement. (This is one of the bugbears for would-be designers of benchmarks for disk systems!)

Then to measure the effects of sharing, I set the second user program to loop continuously and timed the program for the first user. With this sharing, the execution time increased from 33 seconds to 205 seconds. This increase is explained partly by the competition for buffer space in the hub, but I suspect largely by the greatly increased disk head movement as the head moved constantly between the two files. This is inevitable for physical reasons under any operating system. Sharing access to one disk is going to have a big impact if a number of file-intensive activities are run at the same time; but this should not be a problem for programs where disk access is only occasional (eg for occasional interactive enquiries).

Sharing a file

However, as I indicated at the beginning of this article, the real reason for a multi-user system is often to provide different users with shared access not just to the same disk, but to the same file at the same time (eg, for stock enquiry and sales order entry from several terminals). But if one program is going to read a record, alter the contents, and finally re-write that record, then that whole updating process must be indivisible. (For if a second program read the same record at the same time and tried to rewrite its new data at the same time, the two processes would interfere with each other). To overcome this problem of synchronisation, a 'locking' mechanism (sometimes called a 'semaphore') is required, whereby a process carrying out an update can 'lock' the record until the update is complete, and whereby any other process accessing that same record at the same time is automatically held up until the lock is released.

On a mainframe database system it is generally possible to apply a lock to any record in this way. However, this can be rather complex (for example if two adjacent records share the same physical disk sector, then it is also important not to allow two programs to buffer two copies of that same sector at the same time).

In keeping with the spirit of micro systems, McNOS implements a simpler compromise mechanism, by providing one central pool of 'locks' stored as 128 bytes in the hub. A user program can set a lock simply by writing to the appropriate byte, and release it again by clearing that byte. It is up to programs which wish to share access to the same data to agree on which locks they are to use and when they are to use them. In general, the programs will by agreement associate a lock byte with a whole file rather than with an individual record as this avoids the problem of two adjacent records sharing the same buffer. It also avoids the problem of the restricted ▶

```
; BENCHMARK 3
 "S"
NUL K := 0
LOOP:: K := (K + 1)
NUL A :=(K / K *K + K - K)
IF K < 1000
   GOTO LOOP
ENDIF
 "E"
```

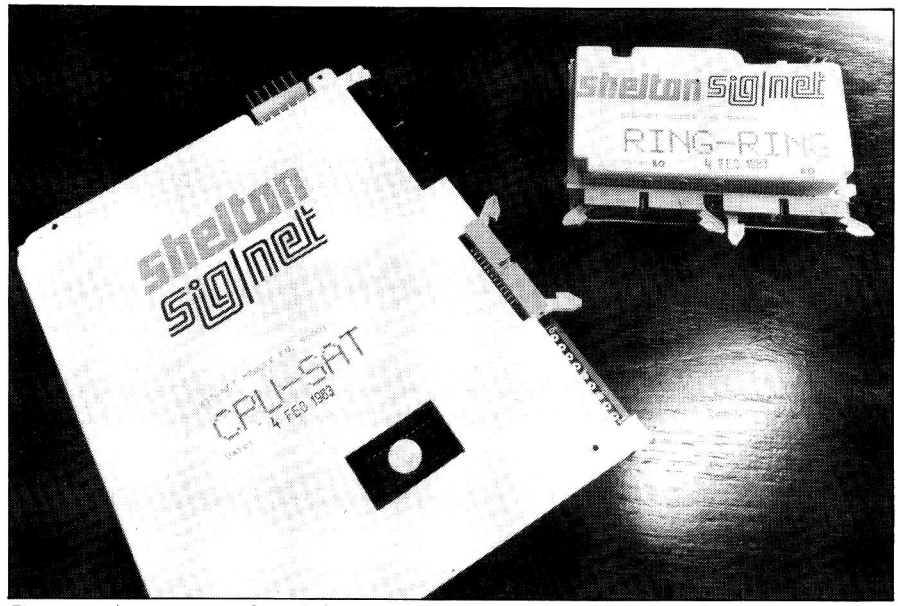
Fig 2 Coding of PCW Benchmark Program 3 in McNOS Terminal Command Language.

Benchmarks

BM1	1.1
BM2	3.4
BM3	9.6
BM4	9.3
BM5	10.0
BM6	18.1
BM7	28.9
BM8*	51.3
Average	16.5

* *Full 1000 cycles*

For a full explanation of Benchmark timings, see PCW *November 1982.*



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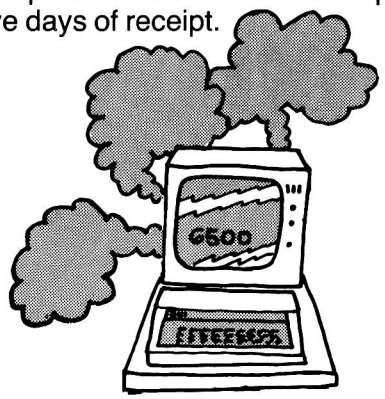

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Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

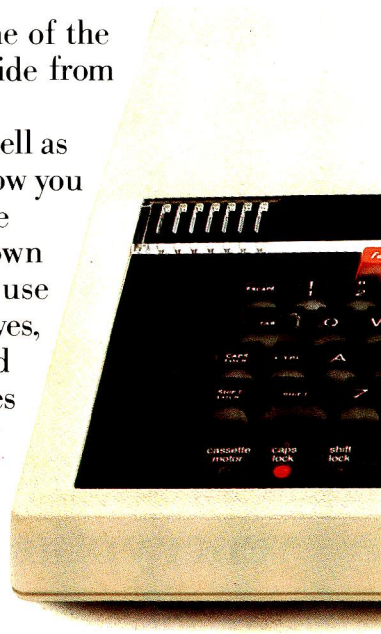
The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.



You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

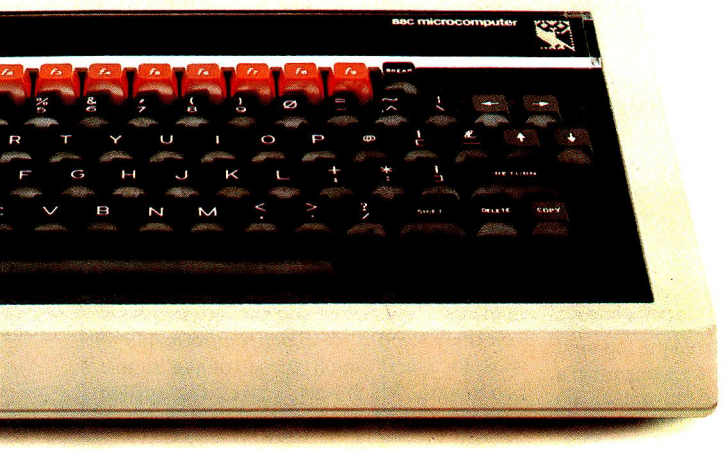
Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.



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number of locks (even if a bit rather than a byte is treated as a lock, this still only provides 1024 locks).

McNOS maintains the lock record on the hub as if it were a file (of just one record) called LOCKSTAT.SYS, though this 'file' is in fact stored in RAM and never written to disk. A user program which wishes to set a lock simply generates a request to read this record. If the record is returned with byte zero set to non-zero, this indicates that some other process is itself busy setting a lock; the program must then wait and try again later. When the record is returned with byte 0 set to zero, this program may examine the bytes (or bits) it wishes to set, and if it is clear to proceed set them and rewrite the record. (The reverse process must be followed later to clear the bytes and hence release the locks.)

To measure the impact of this locking mechanism, I next changed the Benchmark program for the first user so that it shared exactly the same data file as the second user. McNOS provides a particularly convenient way of doing this, for it is possible to create in one directory entry a pointer not simply to a file, but rather to another file entry in another directory. Thus all I needed to do was to change the directory entry for the first user so that the original file name now pointed to the data file of the second user. Running the Benchmark for either user alone now took 54 seconds (ie, I was using the 'slower' of the two data files as far as disk head movements were concerned). I then changed the Benchmark program itself for the two users, so that each read/write pair was bracketed by a lock and an unlock operation as would be required for sharing the file. Now running the Benchmark for either user alone took 106 seconds — a measure of the overheads of using the locking mechanism.

Finally I ran the programs for the two users simultaneously. This meant that the overheads of the locking mechanism, of buffer sharing in the hub and of competing head movements were now all included, resulting in a total execution time of 262 seconds. All of which simply shows that the sharing of data in this way consumes resources (as usual you do not get 'owt for nowt').

Another important resource is of course software. Just because the operating system provides a locking mechanism does not mean that you can take any CP/M system, run it from two terminals, and neatly share simultaneous data access. This will happen only if the program is explicitly written in the first place to use the locking mechanism. At least two general data management packages are already available which use the McNOS locking mechanism: 'Superfile' from South-Data of London (reviewed in *PCW* January 1983), and 'aDMS' from Advanced Systems of Stockport (*PCW* review shortly).

Multi-user software

Thus in the Sig/net multi-user configuration we can see hardware which is a simple extension of a single-user system. However, the software extension is not quite so straightforward when moving from a single-user to a multi-user operating system. The need for such a system of course became apparent some considerable time ago. Unfortunately, the first attempts by Digital Research to extend CP/M in this direction ran into a number of difficulties. Therefore Shelton was obliged to look elsewhere, and eventually obtained the McNOS (Micro Network Operating System) system from its originators in the USA. McNOS aims to provide a filestore and printer spooling system in the hub processor, plus a CP/M-like environment for each satellite user, and the necessary communications software to link them together. As others have found who have followed the same route, a lot depends on exactly what you mean by 'CP/M-like'. While a well-behaved program may just use CP/M by calling on it in the approved fashion for any functions it needs to be carried out, many other programs also call upon the internal subroutines of CP/M or utilise direct access to its internal data tables.

Indeed, in the early days of CP/M, many programs were forced to employ such dodges in order to work at all. (One well-known package reportedly follows each call to write to a file by a 'close' call in order to force the writing of any partially filled buffers; though the file is thus repeatedly closed and never subsequently re-opened, earlier versions of CP/M would still allow the following 'writes' to take place.) For such programs any strict implementation of CP/M is sure to stop them running. With additional work by Shelton, these problems were eventually overcome by relaxing the conditions of the CP/M-like environment to permit such dodges to be employed.

In the single-user versions of CP/M such dodges did little harm since, if the worst came to the worst, the user would only upset his own program. In a multi-user situation, however, it must be realised that such dodges, if incorrectly employed by a user program, can upset other users as well. This has to be accepted as the price of making sure that the whole wealth of existing CP/M software will continue to run in the multi-user environment.

Before looking at how disks and files can be shared between several users, I thought I should first check how much delay is introduced into file accesses for a single user with a file which is no longer on his own satellite system, but which is now accessed on the hub through McNOS over the connecting lines. For this purpose I constructed a file of fixed length records, and wrote a simple Basic program which read and then rewrote each record. Records were taken alternately from either end of the file, stepping up from the bottom of the file and down from the top until the two met in the middle, thus ensuring a reasonable spread of disk head movement. To provide a norm for my measurements, I first ran this program in a true single-user stand-alone CP/M Sig/net system with floppy disks, and obtained an execution time of 257 seconds. Next I transferred the floppy disk to the hub of the multi-user system and re-ran the program from a satellite. The first thing I noted (cynic that I am) was that the program still ran, and that the floppy format was indeed the same under McNOS as CP/M. Would you now care to guess the execution time running over the network? In fact it was 53 seconds, a *reduction* of almost 80%! The reason for this of course (and it may be 'of course' now, but I confess I didn't expect it at the time) is that much of the 64k RAM in the hub system can be devoted to filestore buffering, thus minimising the number of physical transfers actually needed. (If other users had been running at the same time, they would have taken their own share of these buffers. Where there is competition, McNOS sensibly arranges to keep in its buffers that information which has been most recently accessed.)

The terminal command language

In the beginning were mainframes, which ran programs in batch mode. Because the user could not direct his program from a terminal, but had to think ahead for every likely eventuality, the operating system provided a 'Job Control Language' to help in directing the compiling, loading and executing of programs. Some Job Control Languages were so elaborate that they could even be used to solve differential equations (or so rumour had it). Then came the micros and operating systems like CP/M, with very simple commands which could be used from terminals. This command structure could hardly be dignified with the title 'language' (even though SUBMIT and XSUB do give the possibility of issuing several commands at once). There does seem a need for a more comprehensive job control language, even on micros, for tailoring packages and giving the user turnkey systems. (Sometimes this is done through a specially written program, or via a general-purpose 'front-end' package which sits 'on top of' CP/M.)

McNOS tackles this situation by providing its own job control language, complete with variables, arithmetic and assignment statements, conditional expressions, and subroutines. All this is of very great power, but at the cost of considerable overheads in processing time. To test this out, in a pale imitation of those who solved differential equations with the job control language on mainframes, I coded one of the *PCW* Benchmarks in the McNOS command language. This 'program' is shown in Figure 8. I estimate (since I didn't feel inclined to wait for the whole 1000 iterations to finish) that this program would have taken over 14,000 seconds to complete (compared with 9.6 seconds in Basic)! Time may not be so critical in more typical job control situations, but it must be possible to do better than this. However you do not need to use it if you don't need it. It is perfectly possible to stick to a very small subset of the simple commands, which then makes the system very like CP/M. Unfortunately, of course, it can not be exactly like CP/M because it is necessary to maintain a unified underlying syntax capable of supporting the larger language too. As a fairly experienced user of CP/M I must say I had no difficulties with the differences, though they would prevent a novice user from working with a standard CP/M primer as a guide. (I have heard it said that at least one user was so impressed by the

Goto page 232

REAL INTERFACE

Microcomputers make excellent laboratory tools — provided you can connect them to the outside world. Maggie Burton reports on one way of doing just this.

The use of micros in lab monitoring and industrial control is one which shows a great deal of potential. It also has attendant possibilities in such areas as hospitals, farming and anywhere else requiring the predictable control of machinery and recording of dynamic data.

And now you can purchase a controller card to run a system called 'INLAB' which links up to a BBC Computer. This comes from Digital Design and Development (3D) of West London, which also supplies INLAB interfaces for the PET, Apple and Superbrain.

Much of the company's work has been for large corporations. It looks quite a success story. The Government's Road Transport Research Centre is a part of this, as is the National Physical Laboratory. 3D has supplied both complete (software-inclusive) systems and untrimmed interface boxes here. The University of Keele uses one of 3D's systems for laboratory monitoring. Cam Gears of Clevedon uses a 3D interface with a PET to test out performance motor parts. One example of this is noise testing on power steering valves. Cutting noise down as far as possible means first finding out where it comes from — it can be either airborne or fluid-borne. Looking for noise sources and recording results was previously carried out laboriously using a frequency analyser. It is now performed using an analogue-to-digital converter and the time taken is shorter by a factor of 30.

Medical applications for 3D's interfaces include testing pacemakers (not while they're inside people, of course), which obviously have to be extremely reliable before they can be supplied to hospitals. Another use is in monitoring the effects of different drug concentrations on muscle tissue.

The applications for such interfacing systems are manifold. Dr Ai-Kibasi of 3D cites such utilisations as the control of production-line machines (a controversial prospect indeed) and says, 'Micros do this cheaply and reliably. They don't take holidays or tea-breaks. They free people from the boring jobs and enable them to be retrained.' This is certainly not everyone's opinion, especially in the light of today's appalling unemployment figures, but Ai-Kibasi's ideas are clear-cut. 'Microtechnology can really create jobs,' he says.

One widely applicable area in which monitoring/controlling hardware has proved to be very useful is in quality control. Systems can be set up which monitor deviations in, say, the thickness of a fibre. Should the thickness stray beyond either upper or lower limit, an alarm could be activated by the micro to alert an operator or machine manager. It's easy to see how many other tiresome manual tasks could be undertaken with a micro.

A more deserving usage for this type of equipment is in helping the disabled. Physiotherapists might find that patients with balance problems would benefit from a system which involved their standing on a pressure sensitive pad while looking at a computer-generated picture of the soles of their feet. This might sound a bit odd but the principle is rather clever. The picture would show which areas of the foot bore the most weight and the patient could be taught to keep his weight on the right parts of his feet — thereby improving his balance.

Switching systems can enable people with limited manual coordination, or those who have lost limbs, either to 'type' or to program/control computers. Ai-Kibasi demonstrated a ten-switch bank which operates by simple finger-presses. The switches turned numbered reels and relayed the number to a BBC Micro, which simultaneously displayed them on its screen. As well as helping the disabled to communicate with the world at large, such a system could also help to improve coordination. You could get a patient to put a set number on the screen in as fast a time as possible. Repetition of such exercises would, in the fullness of time, almost certainly be beneficial.

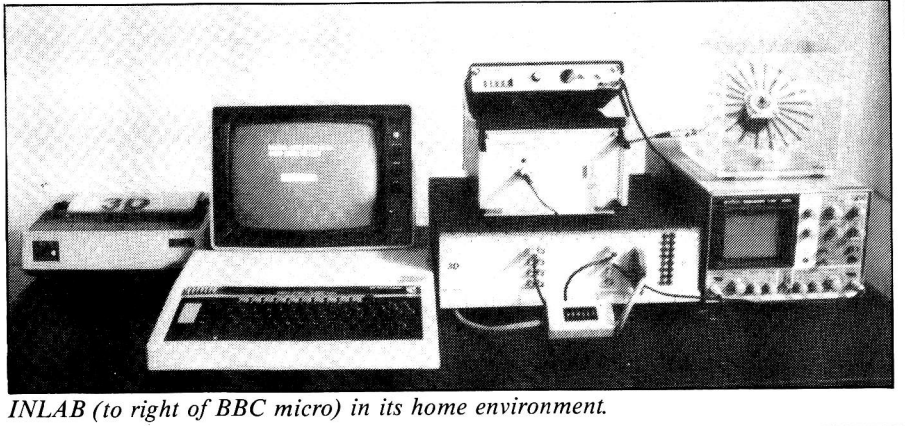
INLAB itself is a modular system. Obviously the controller card is an essential component, but after that the world's your oyster. Interface cards can be slotted into the INLAB box and there is an impressive array of these. They include transducer amplifiers and multiplexors, analogue-to-digital converters (either 12, 14 or 16-bit), stepper motor controllers, frequency/event counters and real-time clock/calendars. The basic INLAB rack and controller card costs under £400 and interface cards can be added at prices ranging from £100 to £500 per card, depending on the application. INLAB racks can also be linked together and the only limit on the literal amount of apparatus which can be controlled is the size of the micro's memory and therefore the complexity of the software it will run. INLAB systems can be run remotely using a modem, and networks of micros can control really complex systems.

3D supplies some 'ready-made' software to drive its equipment. If required, however, it will construct programs to specific requirements. For this it needs a six-week commissioning period and modification and debugging is carried out within that time free of charge. The basic software which I have seen is user-friendly and fast — two qualities which are of paramount importance in control applications. Problems with different versions of the BBC operating system were encountered and, says Ai-Kibasi, overcome. This is partly due to the fact that most of the software is in machine code, meaning that many ROM discrepancies either don't apply or are easily catered for.

3D feels that the BBC micro has good capabilities at a reasonable price. Dr Ai-Kibasi of 3D explains that Beebon is 'a reasonable machine for the price and a powerful one. People are not aware of how this machine can be used in industrial production.' Other machines for which 3D produces interface systems include PET, Apple and Superbrain. Controller cards enable all these to run the INLAB system.

Although 3D does not supply BBC Computers, it will endeavour to repair them if need be, as well as all its own equipment. Repairs costing under £30 are performed free of charge, and all equipment carries a 12 month warranty. 24-hour maintenance is supplied — again this is extremely critical in industrial applications.

After four years in business, 3D's customer include giants like BP, Esso, Kodak, General Foods, Tate & Lyle and ICI. Equipment has been sold in Japan and Hong Kong and it plans to supply its hardware to Europe. It's encouraging to see a British company applying technology throughout the world like this. And as Ai-Kibasi observes. 'The UK is very good at creating technology but not so keen on applying it.'



INLAB (to right of BBC micro) in its home environment.

HUNGRY PUNTERS

A whole show devoted to an operating system? Ian Litterick reports from CP/M '83.

The world is a funny place. You can organise an exhibition and conference around something as unromantic as a computer operating system. You can advertise the exhibition without even bothering to explain what the initials 'CP/M' stand for (I'll explain soon for the benefit of new readers). You expect to get about 25,000 people to come to your exhibition over three days. But in fact over 50,000 people turn up, hungry for information on the latest programs and hardware add-ons.

CP/M '83 ran from 21-23 January and was more important as a milestone in the development of the micro than because of the new products that were there. It was the first CP/M exhibition. It was probably the biggest first-run computer exhibition ever — attracting as many visitors as Comdex, the long-established jamboree which caters for the whole of the American computer trade.

CP/M '83 was organised by Gerry Milden, President of Northeast Expositions. In carpet-bagging style, he aggressively sited it in San Francisco, traditionally the home of the West Coast Computer Faire, to the irritation of Faire organiser Jim Warren. The Faire takes place a few weeks later in March and is aimed at many of the same end users who turned up to CP/M '83.

CP/M '83 was significant because of who was there, exhibiting. It was equally significant because of who was not there. And it was significant because it marks a crucial moment in the market for computer systems and software. There were important lessons to be learned at CP/M'83 for anybody concerned with computers, whether as a user or developer of hardware or software. That probably includes you.

The initials 'CP/M' are usually said to stand for 'Control Program for Microprocessors'. CP/M is a program which sits there in a computer all the time and deals with getting data into and out of the machine — displaying it on the screen, storing it on disk and retrieving it from disk. It is called a Disk Operating System (DOS or OS), although it is not only the disk which it controls.

CP/M is important because it is a universal operating system: it is used on a wide variety of different computers. Digital Research Incorporated (DRI), which markets CP/M, claims that there are more than a thousand different types of microcomputer, from 700 manufacturers, offering CP/M. Some 800,000 CP/M systems have been sold — making it the most common micro operating system. Nobody quite knows how many commercial programs there are which can run under CP/M, but DRI reckon that it is well over 3000.

CP/M means choice. If you buy a CP/M system you know that you are likely to be able to find software to do anything which it is possible for micro software to do. For manufacturers of computer systems it means they can concentrate on making computers, without the terribly expensive and time-consuming task of having to develop software as well. For software authors it means a large potential market of people who will be able to use your software.

Until recently the rivals for CP/M have been proprietary operating systems — OSs developed by manufacturers to run on their machines only. Apple DOS has sold in large quantities for the 700,000 or so Apple computers: but you can buy CP/M conversion boards for Apples so that they can run CP/M. I am not aware of any Apple conversion boards to let CP/M machines run Apple software. TRS-DOS, Tandy's operating system, is also widespread, as Tandy makes what were, for some time, the world's biggest-selling micros. Tandy made the mistake of not even giving all its own machines the ability to use the same software and data. Commodore also has its own operating system.

The cost to these companies of writing and supporting their own operating systems is huge. Only the biggest companies can afford to do it. These companies want to have their own operating systems because it means that they can 'lock people in' to their software, and so control a much higher proportion of the profits generated by their systems. They can also lock people out. Consumers end up by buying something else.

So it was interesting, to say the least, that Tandy Corporation was present and prominent at CP/M'83. Until now Tandy has refused to offer CP/M, and has been unhelpful to customers who have insisted on using CP/M. CP/M has long been available from other suppliers to run on Tandy computers.

Now, however, CP/M is available for the Model II. It is one of the first available offerings of the latest improved version of CP/M, called CP/M-Plus. It was known as CP/M version 3.0 during the long period whilst it was gestating. It now does many of the things which an operating system should do (some of which TRS-DOS has always done). It has a HELP system to prompt you as to what commands you can give. It allows you to change disks in the middle of a program and to put time and date stamps on files. In addition, it features a number of technical developments with such jargon-ridden labels as hashed directory access, LRU record buffering and multi-sector I/O. I'm sorry for the obscene language but it means that CP/M-Plus works faster.

Tandy even used CP/M '83 to announce a new computer, the Model 12, which is a revamp of its Model II with double slimline 8in disks. Who wants 8in disks? Tandy did not announce a CP/M 68k for its useless Model 16, which has a 16-bit Motorola 68000 chip idling away inside it. It is useless because there is no software available for it, not even high level languages. CP/M 68k, the version for the 68000, was, however, to be seen on another stand — running, you may have guessed it, on the Model 16.

Commodore was also present at CP/M '83, rather apologetically showing the Commodore 64, which offers CP/M as an add-on option. Commodore's stand was not impressive. It looked like somebody had decided at the last moment that perhaps they ought to take a stall and bring a machine along after all. Which was disappointing, considering Commodore's recent announcements and its new portable CP/M system.

Apple was not there at all. It had just announced Lisa, which still has its own proprietary operating system. Indeed, Lisa mainly *is* an operating system. It will be interesting to see how long it takes before Lisa users say 'Hang all that fancy window and mouse stuff. Let's get on and do some work with the machine,' and use CP/M68k or Xenix on it. (Both of them are to be available. Apple recognises that customers will not risk being locked out.) Lisa also

uses the superfast 68000 chip, but at the moment it is frustratingly slow to anybody who has access to a proper 8-bit machine(!). The overhead of doing all the fancy display and windowing is just too great.

The Xenix which Apple is making available for Lisa is Microsoft's version of Unix. Unix is an operating system for minicomputers which is unusable and unintelligible to anybody except Unix users and programmers. The latter love it and swear by it, but Unix is not an end user's operating system. Tandy has just announced that it will supply Xenix to all Model 16 users, as a multi-user operating system. This will instantly double the number of Xenix users in the world. There are not many Xenix users in the world. Yet. See below.

Microsoft is one of the major suppliers of software for CP/M as it sells MBasic and other languages. It was also conspicuously absent from CP/M '83. It is now the arch rival of Digital Research, and poses a major threat to CP/M. For while CP/M has trounced all opposition in the 8-bit world, the story is very different in the new 16-bit era.

When IBM announced its Personal Computer it announced that it would run CP/M as well as its own PC-DOS operating system. PC-DOS comes from Microsoft and is the same as MS-DOS, which Microsoft sells independently. PC-DOS comes free with the IBM. But IBM supplies CP/M-86 (the version which runs on the 8086 family of chips which the IBM PC uses) for some $250. So it is not surprising that, according to Portia Isaacson, a micro industry guru from Texas, only some two percent of IBM PC users have CP/M. This is disastrous for Digital Research because all observers agree that IBM is going to be the major force in micros from now onwards. It is not that IBM has a particularly brilliant machine. But IBM's marketing muscle is such that it is in everybody else's interest to make things which are compatible with IBM.

Digital Research held up CP/M version 3.0 for a year because it was working on producing CP/M-86 for the IBM PC. So it is doubly galling to be selling so few CP/M-86s for the IBM PC. At CP/M '83 Digital Research started to strike back. DRI offered a new and improved version of CP/M-86 for the IBM PC for only $60.

It is arguable that Digital Research should be giving CP/M-86 away at this stage. Microsoft's MBasic is already the most popular language for micros. But Microsoft has deliberately not done a version for CP/M-86, so many MBasic applications packages will be difficult to convert to run under CP/M-86. Many authors will not bother to do so, preferring to develop new products which will run on the IBM under MS-DOS.

Conversely, Digital Research is not doing a version of its popular CBasic language to run under MS-DOS. But DRI is in a weaker position because authors will usually find that it *is* worth converting their programs to MBasic, or to some other language (Pascal or C) which runs under MS-DOS. Once they have converted they are unlikely to convert back, or to want to continue developing software in CBasic. So Digital Research's user base will dwindle. DRI is now considering making its languages available under MS-DOS. But it may not commit itself until too late.

DRI took other aggressive steps at CP/M '83. It introduced a version of the Logo programming language for the IBM PC. Called 'DR LOGO' it is a high quality interpreter with added facilities including windowing for text, and extensive HELP screen. With it DRI hopes to make an impression on the schools' market where IBM is now selling in large quantities. Gary Kildall, the writer of CP/M and DRI's founder, is a fan of Logo.

Digital Research also announced CP/M-86 versions of its PL/1 and CB80 languages. CB80 is the fully compiling and slightly enhanced version of the CBasic structured Basic language. It is good to write in and runs very fast, so that you can write high quality (Wordstar standard) professional software. For instance we have used it to write a typing tutorial package of a completely different standard from others which use interpreted Basics. (It is so fast that it measures your typing speed and analyses your errors while you are typing — without using any machine code.) It will be interesting to see whether CB86 performs as well as CB80. If it has been translated rather than rewritten it may well be slower, despite the advantages of the faster 16-bit microprocessor.

The final announcement from DRI at CP/M '83 was of its portability strategy, which is to be based on the language C. C is a language which has been associated with the operating system Unix. Unix was written in C, which was designed as a language for writing operating systems. C is also comparatively portable. That is to say programs written in C can usually be transplanted to different machines with comparatively few changes. Digital Research has written CPM 68k in C and is making its own version of C available under CP/M-86 and CP/M 68k.

C tends to be the language used by the heavyweight programming houses which do operating systems, languages, word-processors and spreadsheets (and which often do most of their programming on minis with Unix). It produces fast and compact code. Despite the trendiness of languages like Pascal, it appears that C is more and more likely to be the first language avaiiable for new operating systems and new chips. Software houses that want to stay ahead may be advised to look hard at C.

It is also interestng that Microsoft is reported to be approaching much more closely to Unix/Xenix in its second version of MS-DOS/PC-DOS. Microsoft also has a C compiler. Versions of C vary, as they do with other computer languages, but with care C could be the answer for those who want to write for both CP/M and MS-DOS.

As well as being a triumph, CP/M '83 could be the zenith for Digital Research. From here on most of the dollars are going to be in 16-bit software, if for no other reason than that it is an IBM world. Soon the Intel 80186 will be widely available. It offers 16-bit power as cheaply as many 8-bit systems because it is integrated with most of its own support chips. On present trends it is MS-DOS/PC-DOS which will be the universal operating system for the 80186.

Arguably Digital Research is spreading itself too widely by providing versions for any and every chip — the 68000 and Z8000, and as well as all the Intel range. It will incur increasing Research and Development and support costs as it spreads its numerous operating systems and languages across the chips. But its share of the user base will dwindle as the mass market goes to the rival Microsoft OS. It will be interesting to see whether Digital Research can fight back over the next crucial year or so.

CP/M '83 organiser Gerry Milden's aggressive approach has also led him to schedule an exhibition for the IBM PC a few weeks before one which Jim Warren is organising. In fact he is organising no less than two PC '83s, for June and October this year on the West and East coasts of the USA. Perhaps they point the way to the really big shindig next year, sponsored by the carpet-baggers of the micro operating system world, Microsoft. Will it be MS-DOS '84?

END

"Plug-in computers are destroying the art of television."

DORK IS THE WORD

Alice Julianson and Brad Robinbeer explain Dork, a revolutionary program generator.

There are several program generators on the market now. Some of these claim to make it possible for a naive user to construct complex programs in plain English. This is often not actually the case. Some program generators require a knowledge of such programming concepts as branching; others still require that you learn complex command syntax or terminology to use them.

But Dork is very different. It takes a step – hitherto undreamt of (for the next five years or so at least) – in the direction of natural language understanding. You can boot it up and use it from scratch with no knowlege of computers whatsoever. Furthermore you can print out your instructions to the generator and understand them perfectly every time – because they're written in English.

Dork stands for Diagnostically Optimizable Recursive Keyword, which is a mnemonic tailormade in honour of the place where the program was created – Dorking. Nevertheless it is an accurate name. The only command you'll ever need to know to operate this software is 'DORK'.

Loading Dork

At present Dork is only available on one machine – that on which it was pioneered, the Sirius 1. It only runs under MS-DOS although a CP/M-86 version is planned for the near future.

The program comes on two disks. One is the dictionary disk and the other the system disk, which also contains the operating system. Dork is booted up in exactly the same manner as loading WordStar or Multiplan. It loads very fast and displays a prompt of DK> which signals that it is ready for input. The Dork program itself is comparatively small. It is the dictionary disk which holds the most important information. The system disk is used to save programs which have been constructed.

Program construction

Dork operates on a stunningly simple principle. The dictionary disk contains 1500 words, each of which is linked to a machine code program. These machine code programs cater for every possible connection between two words.

You begin by naming your program. It's really best to have the whole thing written out on paper before you start – as you would in conventional coding – so that you don't get lost. The format for naming a program is [DORK[progname]DORK]. These square brackets are used often in this software. After you've entered your program name you can then go ahead and enter all the 'lines'. These are not lines in the Basic sense. They are component parts of the program like 'add all numbers in list Va' or 'user input "what's the date?"'. You should be able to see from this that Dork is very like English. There are quite fine distinctions between what it will and won't accept and the manual has to be consulted frequently when complicated programs are being put together.

A look at Figure 1 will demonstrate the type of input Dork will accept. It has no regard for literary trimmings, nor does it recognise past imperfects and present participles. The crux of the matter lies in linking words up correctly. You can't print a word *in* a line, for instance, but you can print one *on* it. Dork makes a distinction between 'computer' and 'user' – even if implied. For instance, 'read [address] from disk' implies and therefore means that the computer performs the operation of reading the specified file from disk. The word 'read' is used also to mean scanning either screen or keyboard. So 'read keyboard until [E]' is like saying 'GET A$: IF A$="E" . . .' in Basic, only it's very much more versatile – and readable as it's doing exactly what it says it is.

Notice that names for files and specific keys (or disk drives and ports) are all enclosed in square brackets. Words to appear on the screen are enclosed in quotation marks. An interesting feature of Dork is that you can literally include variables in your programs. These are prefixed with V or SV depending on whether or not they are numeric. 'Print SVax on screen' means 'print the contents of string variable ax on the screen'. Variable names can be up to four characters long but may only be alphabetic.

So if you're writing a program with only very few variables in it you can refer to these as 'list' or 'word' or 'number', although it's really easier to use variable names. Dork also recognises words like 'sum', 'product' and 'remainder'. Its big disadvantage is that, in the quest for language understanding, the authors have left signs like '+', '=', '*' and '–' out of the dictionary. Leaving these in would have saved a lot of time wasted in typing them out in full. Calculations are performed using the format '10 divided by 5' or '4 plus 2'. Again it would have been easier if conventional notation had been used.

Programs are entered in the format shown in Figure 1. Although it looks hard to work out where to split up your instructions, it's straightforward in practice in spite of the fact that you are given no hard and fast guidelines for doing it. The manual says 'Use your common sense – Dork will often understand what you're geting at even if you think what you've written is unintelligible.' An easy mistake to make is to use words like 'the' and 'it', neither of which Dork recognises. Another problem is that there are often two or maybe three different ways of saying the same thing to the computer. This doesn't affect the efficiency of your programs in any significant way, but it does make them a little confusing to read if you need to do the same thing several times within a program and you use all possible wordings for that operation.

Dork includes a set of mathematical functions, which are, of course, essential. Sines, cosines, tangents, logarithms, antilogarithms and exponents are among these. You can negate a number or

```
[DORK[sorter]DORK]
[DORK...user input...DORK]
[DORK...many strings...DORK]
[DORK...tell computer input ended using F4 key...DORK]
[DORK...sort strings ...DORK]
[DORK...alphabetical order...DORK]
[DORK...print all strings on screen...DORK]
[DORK...start line 1...DORK]
[DORK...print successive items on successive lines
        vertically...DORK]
[DORK...stop when end of list reached...DORK]
```

Table 1

variable by prefixing it with 'neg'. Naturally, decimal points are catered for – and the INT function exists in the dictionary as well. Dork accepts numbers up to an accuracy of eight digits.

Editing

Editing Dork programs is very easy. Using the arrow keys you simply position the cursor at the end of what you want to delete (or where you want to insert something) and use the delete/backspace key to erase it (or type in whatever you want to insert). You can edit a program which has been completed once and saved on disk by typing 'DORK[program name] DORK' to call up the program from memory and then 'DORK' to list it out. Editing is then the same as already outlined.

Branching

This is rather complex. This complexity is one of the main reasons why all programs should be written out before they are typed into the computer. Its main advantage is that it requires no computer knowledge at all although you do need to be logical about it.

Let us say, for instance, that we wanted to compare the values of two variables and branch to another part of the program if, say, Va was greater than Vb. The program to do this would look like this:

[DORK[example]DORK]
[DORK . . . user input Va . . . DORK]
[DORK . . . user input Vb . . . DORK]
[DORK . . . if Va greater than Vb execute example(2) . . . DORK]

The last line of that example should give you the vital clue. A program name cannot contain numbers but a program can be split up into branches by sectioning it off using numbers after the name. You can have up to 999 branches in this manner. For very simple conditionals (eg, 'if Va is less than Vb Va equals 0') you can simply include the result of the condition on the same line of the program. These branches are not so much complex to implement as complex to keep track of. You can, of course, use the same branch as many times as you like.

Graphics and sound

Dork is not too hot on these. The Sirius's handling of both is necessarily very complicated and Dorking Software plans to bring out a special graphics/sound version of Dork to cater for this. At present you can print all the graphics characters using their ASCII codes, draw lines – eg, from line 2 column 3 to line 50 column 20 – and plot points using the word 'dot'. It's difficult to apply natural language principles to areas of computing which require numeric treatment.

Using programs

When you have finished inputting a program all that is needed is to 'compile' it using the command 'DDORK'. This command also automatically saves the program onto the system disk as well. It's at this stage in the proceedings that errors in programs are detected. If, during compilation, Dork comes across either a word not in the dictionary or a set of words it does not cater for it responds with the message 'DORKERR:' followed by the word or words causing the trouble. Basically, in compiling a Dork program, the computer looks up each word on the dictionary disk, strings them all together and then saves the whole lot when it's finished. The program is retained in memory and is run by entering the command DORK (without any square brackets or full stops). Unfortunately, at present, if you want to delete a program from memory and go on to start a new one you have to reset the machine and boot up again from scratch.

It must here be made clear that the version of Dork dealt with in this review is version 0.5 and many facilities which will be present on the finished product are absent here. Dorking Software, the company developing the system, demonstrated it to us over a day and allowed us to take away a copy of the manual.

Documentation

The manuals are extensive and well-written. The first of them is an explanation of what Dork is and how to use it. This includes the kind of grammar you can get away with and the sort of limitations the software imposes on your programs. This is nice to read and illustrates all you need to know clearly, with well-set-out examples to help you on your way. The other manual is the dictionary of all the words Dork recognises. Each entry tells you what that word does and which other words it can be linked to. It is understandably very thick. Once you've read and absorbed the instruction manual you find yourself turning to the dictionary far more, although frequent use of Dork, apparently, means that you remember more and more combinations of words.

Conclusions

Dork was pioneered by a young Welshman, Tostig Llewdor, and his university roommate, Jamie Bunrot. These two stalwarts have been computer hobbyists since their childhood, and have both 'wanted to see the day when you could talk to a computer like an old friend', said Llewdor. Dorking Software is the company they set up using Bunrot's family inheritance and, to date, it hasn't made any money – nor will it until Dork is running smoothly enough to be put on sale.

Developing Dork is, according to Llewdor, 'just a matter of time'. 'There are lots of little trimmings we need to sort out, but very few of those now are in the backbone of the thing,' he says.

And it certainly is a revolutionary development. The only thing we could find wrong with it was the fact that actual compilation is rather slow. This, however, is not surprising, considering the sheer computational effort which goes into it.

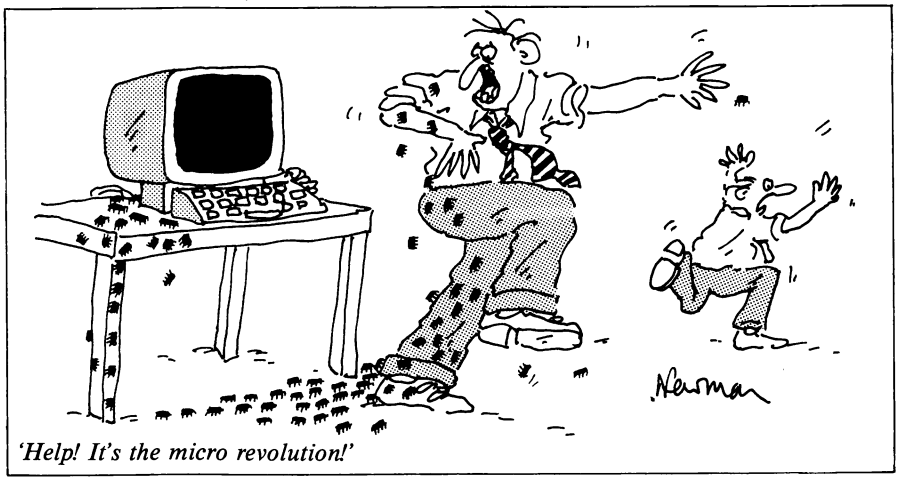
Although it is very easy to use, it does take some getting used to. The command 'syntax' is non-existent – you need only learn a few additions to the word 'Dork', but the use of English words is rather strange. Furthermore, it is as yet impossible to merge two Dork programs and it is also impossible to add machine code patches to them, which would have been a useful provision.

By its very nature, Dork is not too good at handling mathematical programs, although its sorting and searching is very good indeed. Using Dork, you could easily and quickly construct a useful data management system.

The trouble is, though, that at this time no one apart from the authors has ever been 'let loose' on Dork. The limitations outlined here are simply on the basis of a day's demonstration and a long read of the manuals. It could be that there are many, many things Dork cannot do that Basic, say, will. Certainly if it does half the things its authors claim it is a great breakthrough in natural language understanding. If it does all of them that breakthrough is even greater.

Dork should, all being well, be on sale through various dealers by the end of the summer. It will cost in the region of £365 (+VAT). Dorking Software has plans to introduce it on several other 16-bit machines, among them the Apple III, Olivetti M20 and IBM PC.

PCW hopes to be able to provide a full software Benchtest of Dork in the next few months. Meanwhile, contact Dorking's London office on 01-246 8007 for further details. END



'Help! It's the micro revolution!'

A LOOK AT C

Peter Rodwell continues our occasional series on computer languages with a look at C.

The microcomputer world is pretty well off these days as far as languages are concerned. Although Basic still reigns supreme, we have inherited a good range of languages from the mainframe world. Falling memory prices and the advent of 16-bit computers have given us the room and power to get to grips with some of the larger and more exotic languages, giving access to the large pool of software written for the big machines.

In a perfect world there would, of course, be only one computer language. Unfortunately, nobody has yet produced the perfect language (although there are several who claim to have done so), hence the proliferation of languages: one programmer's meat is another's poison.

So it is that from time to time a new language appears, designed to fulfill a need not met by other languages or aimed at a specific area of programming — writing operating systems, say, or accounting packages. Such a language is C, now making itself felt in the micro world although it has been available on big machines for some time. It's the language in which the Unix operating system is written (apart from a few hundred lines of assembler code) and that should give you a clue to C's main purpose in life.

There are three levels of computer languages. At the lowest level is the binary code which the computer 'understands' directly but which is impossible for humans to get to grips with. Above this is assembler language, in which each of the binary codes is represented by a cryptic, but human-understandable, mnemonic. These mnemonics are translated by a piece of software called an assembler into the binary codes. Tedious though assembler programming can be, it does, however, give the programmer complete control over the system and, provided he knows his stuff, produces the most efficient code possible.

Assembler programming does, however, require considerable computing knowledge and takes a hell of a long time to produce the goods — there's a lot of writing to be done and finding bugs can be a nightmare. High level languages have therefore appeared to overcome these problems. Rather than write pages of code to perform a simple operation such as displaying a character on the screen, the programmer needs only to write a single, English-like word such as 'PRINT'. This is translated into binary code by a program called a compiler or by a translator. The difference between these two is simple: with a compiled language, you write your program with a word processor or text editor, save it on disk and then get the compiler to translate it all in one go. A translated language, of which the most popular is Basic, allows you to type in your program and then turns each line into binary code a line at a time as the program is running. Compiled programs generally work more quickly than translated ones because the translation takes a hefty amount of processing time. But it's a lot easier and less troublesome to debug or alter a translated program.

The disadvantages of most high level languages is that the code produced by the compilation or translation isn't always very efficient and usually takes up more memory than a well-coded assembler equivalent. Translated languages not only run more slowly but need the language translator to be held in memory at the same time. These problems may not be particularly important if you're using a mainframe machine but they do matter in the micro world where processors are slower and less powerful and there's less memory to play with.

C seems not to fit into any of these neat categories, though. It's a high-level language, sure, but lacks some features found in other languages. However, it gives very nearly the control which assembler languages offer. This means that while it would be tedious to write, say, a stock control package in C, it is a very handy language for producing operating systems, compilers/interpreters for other languages, and certain types of applications packages such as word processors.

C comes from the people who were responsible for giving us Unix, Bell Labs in the USA. It stems originally from the British-produced language BCPL via an intermediate product called B. Some controversy appears to exist as to whether the next language in the family should be called P or D.

First impressions

Although C is a structured language, at first sight it looks absolutely awful. Take a look at Listing 1, a simple program which counts the number of words in a text file and prints out the total. As you can see, C makes little concession to readability, preferring cryptic symbols to English words for many operations (although not taking this to the extreme of APL).

A closer look reveals that C has some distinct similarities to Pascal, especially when you realise that the '{' and '}' symbols serve the same purpose as Pascal's 'begin' and 'end'. (In fact if you're a Pascal freak you can define 'begin' and 'end' to mean '{' and '}' and use them instead of the symbols, if you like giving yourself extra typing.)

There is a major style difference between C and Pascal. Pascal demands that your program starts with all the subroutines and that each one be defined before it is used. The final part of the listing is, therefore, the main program itself. This is theoretically a neat, orderly way of doing things and makes the compilation process easier but it doesn't make the listing easier to read. C imposes no such restrictions; you must identify the main module by called it 'main' but you can put it anywhere and you can write your subroutines in any order you see fit. To my mind it's preferable to start with the main module, but this is more a matter of personal taste than programming dogma. C also imposes no restrictions on the way the listing is laid out and you are left to devise whichever method of indentation and general layout you find best.

Let's take a closer look at the language, then. In the style of our series of language articles, this isn't intended to be a detailed tutorial but more of an overview of the language's features and potential.

C basics

As with Pascal, C demands that all variables are declared before they can be used and that their type is specified: **char**acter, **int**eger, single-precision **float**ing point and **double**-precision floating point are the standard types. So,

```
int number;
char c;
```

declare 'number' as an integer and 'c' as a character. Arrays are defined as

```
int matrix[10];
```

which defines an array of 10 integers.

C contains no provision whatsoever for handling strings as complete units. Instead, strings are defined and handled as arrays of characters, which is a little awkward at times but generally very useful for the types of applications for which C is most suited.

A typical C program comprises a main section and a number of functions (rather like Basic subroutines) which are called either from the main function or from other functions. Variables defined within a function, eg:

```
funct()
{
int fred;
char K
.
.
.
```

are 'automatic'; 'fred' and 'k' appear only when the function is called and disappear when it ends — they are completely independent of any other variables called 'fred' and 'k' elsewhere in the program. If you want an internal variable to retain its value between function calls, you declare it as type **static.**

So how does C pass parameters to

Illustration by Jo Lawrence

A LOOK AT C

functions? One way is through external variables, declared outside of the main program and any functions and re-declared within each function which uses them. A usually handier way is to pass the value with the function call:

```
funct(value);
```

which is handled within the function by:

```
funct(value)
int value;
{
.
.
.
```

Functions can similarly return values, with the **return(value);** statement. This has interesting implications: you can declare a function as though it were a variable and use it in the same way:

```
int x, funct(), value;
.
.
.
x=funct(value);
```

Operators

C provides a useful range of operators. There are the usual arithmetic ones (+, −, * and /) but the language's syntax allows some operators to be used in unusual ways. To increment and decrement a value, for example, instead of

```
x = x + 1;
```

or

```
y = y − 1;
```

C allows you to say

```
++x;
```

and

```
−−y;
```

But '++' and '−' can be suffixes as well as prefixes, in which case they take effect *after* the variable has been referenced.

So, if a = 6,

```
x = a−−;
```

will give x = 6 but a will then be equal to 5. It is this economy of expression, which permeates the entire language, which makes C a satisfying language in which to program. It does, however, need to be used with care and can produce almost unreadable source code if overdone.

Relational operators, used in testing conditions, are the familiar >, >=, < and <= with the addition of == and !=, tests for equality and inequality respectively. Logical operators include && and | | for AND and OR and there are operators to work down to the bit level and shifting left and right.

Control flow

Program statements consist of a single line, terminated by a semi-colon but groups of statements can be enclosed between braces ('{...}') and treated as a single statement in certain cases.

One example is the **if** statement:

```
if ( a == 1 )
  {
  statement1;
  statement2;
  }
else
  statement3;
```

The expression used with if is evaluated to true (1) or false (0), so that the example above could be re-written:

```
if ( a )
  {
```

etc.

Using the negation operator '!' turns

```
if ( x = 0 )
```

into

```
if ( !x )
```

— ie, 'if not x'.

Three types of loops are available, **for** and **while**, which test the controlling condition at the top of the loop, and **do...while**, which tests at the bottom.

```
for ( x = 1; x = 20; ++x);
```

would be equivalent to Basic's

FOR X = 1 TO 20 STEP 1

but the condition needn't be simply numeric — any expression which can be evaluated to true or false could be substituted, so that searching for a character in a string array could be done with

```
for ( i = 0; c != 'a'; ++i )
  c = array[i];
```

which would search through array[] and stop when it found an 'a' (array subscripts start with 0 in C).

The while loop is similarly handled:

```
i = 0;
while ( c != 'a' )
  c = array[i++];
```

for example. But with C's economy of

```
£define         YES             1
£define         NO              0
£define         EOF             -1

main(argc,argv)         /* Count words & chars in named file(s) */
int argc;
char *argv[];
{
int     c,nw,nc,inword;
FILE *fp,*fopen();

fprintf(stderr,"\nWord count program\n");
if (argc == 1)
  {
  fprintf(stderr,"You didn't specify which file you want counted!\n");
    goto stop;
  }
else
  {
  while (--argc > 0 )
    {
    if ((fp = fopen(*++argv,"r")) == NULL)
      fprintf(stderr,"Can't find file '%s'\n",*argv);
    else
      {
      fprintf(stderr,"\nCounting words in '%s'...\n",*argv);
      inword = NO;
      nw = nc = 0;
      while ((c = getc(fp)) != EOF)
        {
        ++nc;
        if (c == ' ' || c == '\n' || c == '\t'
        || c == '\n'  || c == '/' || c == '-')
          inword = NO;
        else if (inword == NO)
          {
          inword = YES;
          ++nw;
          }
        }
      }
  printf("File '%s%s", *argv, "' contains ");
  printf("%d%s", nc, " characters, ");
  printf("%d%s\n\n", nw, " words.");
    }
  }
stop:   exit(0);
}
```

Listing 1

expression, this could be stated as

```
i = 0;
while ( array[i++] != 'a' )
  ;
```

the final ';' being in effect a dummy statement as all the work is done in the condition test!

The **do...while** loop should be obvious by now:

```
do{
  c = array[i];
  ++i;
  } while ( c != 'a' );
```

would be one way, although similar code-cutting techniques could be used to reduce this.

C also gives you a **goto,** hated by programming fundamantalists but useful sometimes nevertheless, especially for escaping from deep nests of loops.

Pointers

As well as referencing a variable's value by the variable name, C allows you to access it with its address, using pointers. Andrew Stephenson's review of C/80 (following) contains an example of this, in the sample program. The array *msgtxt[] contains not the strings which follow it but the addresses of the first character in each string. Each string is accessed by obtaining the appropriate address or pointer from *msgtxt[], placing it in 'msgptr' and using this to find the string itself, which is then printed out character by character. In a situation like this, the programmer doesn't have to worry about where the actual strings are stored — the compiler does it automatically. Likewise, the compiler adds a null byte to the end of the string to provide a method of detecting its end, used in Andrew's program in the statement **while (code = *msgptr++)** — can you figure out what this does?

The example is a typical use of pointers — accessing an array, often via an array of pointers to arrays. Generally, using pointers instead of array subscripts results in faster, more compact code but can lead to inpenetrable source code!

I/O facilities

The C language provides no I/O facilities whatsoever, a rather surprising attribute at first sight. I/O is in fact handled by a standardised library of I/O functions: **getchar();** in Listing 1 is an example, as is **fprintf();**, the latter being a powerful print-out command with formatting capabilities.

As C was developed for the Unix environment, it naturally has Unix-type I/O characteristics. I/O is carried out through files and can be re-directed by changing the filenames. I/O can also be controlled from the command line. The word count program, when called, must have the name of the file to be counted in the command line — up to 20 files can be specified in the line, in fact — and if you tag '>PRN:' on the end, output goes to the printer instead. Change this to '>filename' and the output is written to a disk file of that name; '>>filename' appends it to the file.

Because I/O is handled in this way, it is totally machine-independent. So unless your program contains machine-specific features (screen handling, for example), you can be almost certain that it will be completely portable. And it is this portability which is one of C's greatest assets and one reason for its increasing popularity; I think it's fair to say that C is more portable now than Pascal, judging by the number of different Pascals around.

Learning and using C

C's major drawback as far as the novice is concerned is its lack of documentation. There are,to my knowledge, only two books on the subject. The standard work is *The C Programming Language* by Brian W Kernighan and Dennis M Ritchie (Prentice-Hall 1978, ISBN 0-13-110163-3), which defines the language and gives a sort of tutorial. It is, however, quite terse and assumes you are already familiar with programming terms and concepts. The section on pointers is particularly obtuse and, despite ploughing through it several times, I still feel uneasy using pointers — strange things can happen if you don't get it right! On the plus side, the book contains a large number of sample programs and functions to aid understanding, has a practical rather than academic approach to the subject and contains a full, formal definition of the language at the end.

The other C book is *The C Puzzle Book* by Alan R Feuer (Prentice-Hall 1982, ISBN 0-13-109926-4). This assumes familiarity with the language and is devoted to pointing out potential snares for the unwary C novice. It is to the same format as *The C Programming Language*, and contains extensive cross-referencing to the latter's language definition. Please don't ring me up to ask who sells these books — you can order them through any good bookshop. A number of companies now offer C programming courses, notably Bleasdale (01-828 6661).

To get to grips with C, I was fortunate enough to borrow the C86 compiler from Computer Innovations Inc (75 Pine Street, Lincroft NJ07738, USA, tel (201) 530 0995; I don't know of a UK distributor). The compiler is available to run under CP/M-86 and MS-DOS; under CP/M-86 it produces '.CMD' files and '.EXE' files appear for MS-DOS. (Or so it says in the manual — I haven't yet found a way of transferring the MS-DOS version from its 8in disk to the Sirius.) C86 costs $395 but add $20 for postage.

The compiler comes complete with an I/O library plus utilities to create and maintain your own libraries of functions, and adheres to the standard defined by Kernighan and Ritchie. Sensibly, Computer Innovations imposes no royalty conditions on the sale of programs developed with C86 and using the supplied library functions. The manual assumes you are familiar with C and is confined to a description of each function in the library (for which the source code is also supplied, incidentally) plus, of course, instructions for using the compiler.

C86 is a three-pass compiler, which makes writing, testing and debugging very tedious even if you use CP/M's submit facility to do it. The final stage involves linking the compiler's output to whatever libraries are required, to create your '.CMD' program. The compiler provides reasonably obvious error messages (not all of which are documented in the manual) and it can be quite amusing to watch these whizzing up the screen because you left out a '{' near the start of a long program'.

Conclusion

I have tried here to give a taste of C and to describe some of its main capabilities and points of interest. As you should have gathered, C is certainly not the perfect programming language in that it is not suitable for every application. Its strengths lie in the areas for which it was designed — systems software and applications programs such as word processors, in which its more esoteric features such as pointers make for very efficient programs. It would be perfectly possible to write just about any application in C but, although facilities exist for handling things like, for example, random file access, there are other languages designed for — and therefore more suited to — this sort of work. C does, however, offer much of the control of assembler programming while providing the speed and ease of a high-level language combined with complete portability.

SOFTWARE TOOLWORKS C/80

Andrew Stephenson investigates a low-cost C compiler.

In searching for a C compiler, I looked at several including those from Whitesmiths, BD Software and Supersoft. By comparison, The Software Toolmakers' C/80 looked too good to be true, promising an amazingly compact, complete, accurate — and cheap — implementation.

Deriving from Ron Cain's 'Small C', a stripped-down compiler released into the public domain a few years ago, it has been developed by a group of academics intent on providing good software at low prices. The C/80 dates from at least April 1980, version 2.0 from around February 1982. No further revision has yet been announced.

The CP/M edition, the only one I have tried, is supplied on 8in disk; ask about different disk formats. Other editions are available for Zenith computers (the authors started with Heathkit products) and the Osborne. Variations are minor, since the C/80 is written in C, and stem mostly from factors such as DOS limitations and disk capacity. Osborne 1 owners have a smaller selection of sample C programs.

One of the charming traits of academic programmers is that they tend to be less tolerant of imprecision than their hasty commercial cousins. The C/80 has proven very reliable in the five months I have had my copy. In the early stages I was able to provoke it into fits of diagnostic hysterics; but more orthodox source code appears to give it no real problems.

A LOOK AT C

Differences from the full standard are mostly harmless. The C understood by C/80 is more a subset than a variation:
names restricted to seven characters (not eight);
no floating point data types;
no bit fields in structures and unions;
no variable definitions other than at head of a function;
no initialisation of automatic or register variables;
no use of **sizeof** in setting array dimensions;
no **#line** preprocessor command;
no recursive substitution in **#define**;
no macro parameters in **#define**;
no **typedef** operator or **entry** keyword.
Unless you are involved in scientific work, the lack of floating point data types is unlikely to be a problem. The price of having them is compiler complexity, slowness and cost. The world is more measurable in integers than might be supposed.

That said, some users may regret the fact that all data types other than characters are two bytes in size. And characters are signed, so conversion to an integer extends the sign: eg, 80 hex becomes FF80 hex.

Functions must be called with a full complement of parameters, thanks to C/80's back-to-front stacking of them.

The compiler will supply in the HL register the value of any variable named just before **#asm**.

Finally, C/80 users obviously own some ancient equipment: command line **#UPPER** allows normal C code to be written in upper case only. Oh, and some notational anachronisms are accepted (eg, =+ etc).

Using it

C/80 is simpler to use than some of its rivals. One error-free compiler runs produces an 8080 Intel assembly code file. Library fuctions are in a separate file, CLIBRARY.ASM, automatically incorporated later at assembly time, unless you have chosen to compile into a format compatible with Microsoft's Macro-80 relocatable assembler.

CLIBRARY holds a mixture of routines, some essential, some required only by input-output (I/O) facilities, file handling and other system-specific tasks. Careful editing can be worthwhile, since this is nearly 2.4 kbytes in size. You may even wish to create versions with your own mixes to routines.

The next stage is assembly, either with the absolute 8080 assembler supplied as part of the C/80 package, or with another. The final 'COM' file runs on its own.

During compilation, any error causes the display of the offending source code line with the problem site marked and a summary of the problem. Messages are succinct but the manual enlarges on them individually, sometimes humorously: 'too many active **whiles**: Well, congratulations. There's only one table in this compiler that isn't expandable, and you have overflowed it by nesting 20 **whiles**, **fors** and/or **switches**. Simplify your program.'

That remark about table expansion refers to the amount of memory assigned to the compiler's working scratchpads. These are set by default values in patchable C/80 locations (revealed by one of the ancillary files) or by command line flags.

The options are mostly useful. Apart from five for table sizes and one for Macro-80 compatibility, they are:
Include source text as comments in assembly code file;
Treat 'global' variables as external to file being compiled;
Offset all labels by a specified amount, to avoid clashes with other separately compiled files;
Do not initialise 'static' and global variables to 0, to save intermediate file space;
Do not merge duplicate text strings;
Seek CLIBRARY.ASM on a particular drive;
Generate a runtime profile.

Only the last is not too clever in practice. Either of two special files can be included. One causes the running program to display calls to functions (but little else); the other gives the duration and quantity of function

```
fdefine ERRMSG  0                       /* The preprocessor will replace all
                                           occurences of ERRMSG with '0'    */
fdefine MAINMSG 1                       /* Main message text's number       */
fdefine CONDIS  6                       /* CP/M BDOS function 6             */
fdefine ERROR  -1                       /* Err code in o/p message string   */
fdefine OKAY    0                       /* No error found in message string */

int     dismsg(), cpmbyt();             /* These are functions which return
                                           integers                         */

/* The program itself starts here...                                        */

main()
{
if ( dismsg(MAINMSG) != OKAY )
  dismsg(ERRMSG);
}

/* ...and ends here!  It calls function dismsg(), passing the single
   parameter MAINMSG.  C allows you to use the function call itself in
   place of a variable - a function which returns a value effectively
   becomes that value.  If dismsg() is not equal to OKAY, it's called
   again to report the error, this time using ERRMSG as its parameter.
   Now we have to define the function dismsg()...                           */

dismsg(msgnum)
int     msgnum;                         /* Define msgnum, the parameter
                                           passed to the function, as an
                                           integer.                         */
{
char    code, *msgptr;                  /* code is a character pointer,
                                           msgptr is a pointer to characters,
                                           denoted by the '*' prefix        */
static  char    *msgtxt[] =             /* msgtxt is an array of pointers to
                                           the following text strings...    */
        {
                {"\n* * * BAD MESSAGE CODE ENCOUNTERED IN TEXT * * *"},
                {"\nThis\202displays\203 recursion.  Good, eh?\n\n"},
                {" function "},{" messages,\204"},{" using "}
        };
/* Any character with high bit set is a modified message number which
   causes that message to be displayed before completing the current one.
   Hence dismsg() must call itself recursively.  '\' followed by a three-
   digit number defines an octal character.                                 */

msgnum &= 0x7F;                         /* ie, msgnum = msgnum AND 7F hex   */
if ( msgnum >= (sizeof msgtxt / sizeof (char *)))
  return(ERROR);
msgptr = msgtxt[msgnum];
while (code = *msgptr++)                /* *msgptr is incremented after
                                           being referenced                 */
  {
  if ( code & 0x80 )                    /* AND code with 80 hex             */
    {
    if ( dismsg(code) != OKAY )
    return(ERROR);
```

calls (but needs a memory-mapped 16-bit system clock).

Library

It must be said that the C/80 package's support library is no more than adequate, although at the price no one should feel cheated.

CLIBRARY.ASM has some interesting input/output routines. These emulate Unix, in that I/O can be redirected to/from any of CP/M's logical devices or any file by opening a data 'channel' to/from program. (Redirection applies during compilation, too, so error messages can go to disk instead of console.)

Ten functions handle the bare bones of character and file I/O, and memory allocation. The average user would be happy for a while but would soon need to augment them, such as for file deletion. (Kernighan & Ritchie contains more, in the section on the Unix interface.)

Formatted output of mixed text and values is provided by file PRINTF.C, for optional inclusion. This is useful. (Again, K&R is worth looking at.) Other files provide CP/M2+ random file access and chaining of programs. And, apart from some minor demonstration samples, that is that.

```
      }
    else
      {
      if ( code == '\n' )
        newlin();
      else
        dischr(code);
      }
    }
return(OKAY);
}

/* Now define the function newlin(), which simply prints a carriage
   return and line feed.  See how unreadably squashed C code can be if
   you really put your mind to it!                                    */

newlin(){dischr('\r');dischr('\n');}

/* This function displays the character passed to it, using the
   customised function cpmbyt().                                      */

dischr(c)                              /* Display the single character c  */
char    c;
{
cpmbyt(c, CONDIS);
}

£undef  MAINMSG                        /* 'Forget' the definitions of     */
£undef  CONDIS                         /* MAINMSG and CONDIS              */


/* This function shows how assembler code can be incorporated using
   '£asm...£endasm'.  This routine is not portable except when using
   CP/M and C/80                                                      */

cpmbyt(DEparm, Cparm)
int     DEparm,                        /* CP/M DE register parameter      */
        Cparm;                         /* CP/M C register parameter       */
{
£asm                                   /* This switches to in-line assembler
                                          code.                        */
BDOS    EQU     5
        POP     H                      ; Save return address.
        POP     B                      ; BC = Cparm
        POP     D                      ; DE = DEparm
        PUSH    D                      ; Return values to stack
        PUSH    B
        PUSH    H
        CALL    BDOS                   ; Call CP/M
        MOV     L,A                    ; Prepare to return status value
        MVI     H,0
£endasm                                /* Switch back to C code - the
                                          compiler provides a RET      */
}
```

Sample program illustrating various aspects of C. Note that '£' here replaces the normal '#'.

System requirements

C/80 needs 40k or so of RAM, so 48k CP/M should be fine on most computers. Extra memory allows more complex programs to be compiled. No other special needs have become apparent.

Documentation

The 35-page manual is businesslike and forthcoming with hints on using the compiler, optimising code size and speed, error messages, flags, the library, and so forth. The essentials of C are also summarised in an admirably compact form.

Unfortunately, my copy predates my version of C/80. This now seems to have been corrected.

Efficiency

The example program compiled to 381 bytes, excluding the essential routines in CLIBRARY, amounting to few dozen bytes. Ignoring 125 bytes attributable to text strings, 256 bytes of code are left. A quick hand-compilation produced some 85 bytes. However, this is not quite a fair comparison. Large programs developed rapidly can easily justify their greater use of RAM. What is dramatised is the price of using the stack to pass parameters.

Some hand optimisation is always possible, though in this case only three bytes could be saved by a quick inspection of the assembler code. A different program, of 5.5k, had deadwood of only 100 bytes.

On the whole, C/80 seems inherently efficient, though no apparent optimisation is done. Experience shows that, where size and/or speed is paramount, development time can still be saved by debugging algorithms in C, then hand-compiling.

Conclusion

This package has proven its worth, in hobby and commercial work. It is noticeably faster than Whitesmiths, being simpler, and appears to be at least as efficient. The absolute 8080 assembler supplied free (?) is a nice touch and worth something on its own.

Anyone who already has a large investment in code using all data types and/or bit fields may prefer to avoid the conversion job that would be necessary.

For everyone else, as a value-for-money deal C/80 knocks the spots off the competition. However, in future releases The Software Toolworks should seriously consider allowing for the features they so far have not implemented. Why leave a wall only 98 percent painted?

Thanks to South Data Ltd, for corroborative user comments, and Software Science, The Software Toolworks' UK agent, for answering awkward questions. The C/80 package costs $50 (US) or £45+VAT (UK). Updates are promised at nominal sums.

PCW SUBSET

Alan Tootill and David Barrow present more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together in this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET,* PCW, *62 Oxford Street, London W1A 2HG.*

Z80 CALENDAR

In the first Sub Set (September 1980) it was suggested that date (DAY/MONTH/YEAR) to binary date conversions, for easy comparison and scheduling, would be useful. It is strange that, after all this time, the first routines on the subject should arrive in the same month from two readers, Andrew Bain of Welwyn Garden City and John Edwards of Trondheim, Norway.

We deal here with Andrew's Datasheets, CVDAYS to convert Day/Month/Year to a number of binary days from a base Day 1, and CVDATE to convert a number of binary days back to Day/Month/Year. Base Day 1 must be 1 January of any year that is the first after a year exactly divisible by four. Base Day 1, for example, could be 1 January 1621, when, to get the number of days to 20 September 1679 (21082 or 525A hex if you must know) you would put day 20 (14H) month 9 (09H) and year 58 (3AH) to CVDAYS. Andrew usually uses 1 January 1901 as his base Day 1, when input of day 20, month 3 and year 83 will give the number of days to 20 March 1983.

The routines are accurate for years 1 to 179 inclusive but do not attempt the Gregorian correction by which the extra day in February is dropped each century year, except in the years whose numbers are exactly divisible by 400. Fortunately, the year 2000 (exactly divisible by 400) is a leap year, so no Gregorian correction is required for it. The routines will therefore function correctly until 2079. All the same, Andrew would like to know of any slick solution to the Gregorian correction problem. He would also like to see a shorter and faster CVDATE routine, which he calls frequently.

Holding dates as a number of days from a base day has several advantages. It is compact, and calculating the number of days between two events is simply a matter of subtraction. The remainder, after dividing the number of days by seven, indicates the day of the week. Whatever base Day 1 you work from, you can find out which remainders represent which days of the week by getting the number of days mod 7 for each day of the current week or some other week whose days you know.

```
MONTAB:
.BYTE 1FH, 1CH ;Jan=31   Feb=28          1F1C
.BYTE 1FH, 1EH ;Mar=31   Apr=30          1F1E
.BYTE 1FH, 1EH ;May=31   Jun=30          1F1E
.BYTE 1FH, 1FH ;Jul=31   Aug=31          1F1F
.BYTE 1EH, 1FH ;Sep=30   Oct=31          1E1F
.BYTE 1EH, 1FH ;Nov=30   Dec=31          1E1F
```

Table 1

Datasheet

```
;= CVDATE - Convert days since 01/01/01 to Day/Month/Year

;/ CLASS:  2
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Takes a date as a count of days since a nominated
;/               Day 1 and converts it to Day/Month/Year, held
;/               as integers in registers A, B, C respectively.
;/ ACTION:  Copies days-since count into HL.  Divides out the
;/          years by repeated subtraction.  Tests leap years and
;/          adjusts for 29 Feb.  Loads BC with month lengths
;/          and subtracts repeatedly to calculate the month number.
;/          Finally loads registers with values and returns.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  None
;/ INPUT;  Days since 1 Jan in Year 1 held in BC
;/ OUTPUT:  Day-of-month in A; Month-of-year in B; Year No in C
;/ REGs USED:  A F , B C
;/ STACK USE:  6
;/ LENGTH:  67 (and 12 for month look-up table)
;/ TIME STATES:  A reasoned average would be 550 + 64 for each year
;/ PROCESSOR:  Z80


CVDATE:   PUSH   HL          ;save D E                    E5
          PUSH   DE          ;H L registers;              D5
          LD     H,B         ;HL    count                 60
          LD     L,C         ;of days since Day 1.        69
          LD     BC,0000H    ;Initialise the count regs.  01 00 00
LOOP:     LD     DE,016H     ;DE    365 days.             11 6D 01
          INC    C           ;Add 1 to year count and     0C
          LD     A,C         ;get it in A to test         79
          AND    03H         ;year count mod. 4.          E6 03
          JR     NZ,CV2      ;Skip if year not a leap.    20 01
          INC    DE          ;DE = 366 days.              13
CV2:      SBC    HL,DE       ;Subtract a year's days.     ED 52
          JR     Z,CV3       ;Jump if this results in zero 28 02
          JR     NC,LOOP     ;else loop until negative.   30 F0
CV3:      ADD    HL,DE       ;Replace final year for rem. 19
          OR     A           ;Repeat the test for leap,   B7
          JR     NZ,CV4      ;and jump unless leap.       20 0B
          LD     DE,03CH     ;DE    (31+29) days.         11 3C 00
          SBC    HL,DE       ;Compare HL with             ED 52
          ADD    HL,DE       ;the Feb value.              19
          JR     C,CV4       ;Skip if date is Jan or Feb. 38 03
          JR     Z,FEB29     ;Jump if Feb                 28 18
          DEC    HL          ;otherwise drop Feb          2B
CV4:      PUSH   BC          ;and then ignore.            C5
          LD     DE,MONTAB   ;Point to table of month days. 11 XX XX
          XOR    A           ;Clear accum.  for month count. AF
LOOP2:    INC    A           ;Add 1 to month-of-year count. 3C
          EX     DE,HL       ;                            EB
          LD     C,(HL)      ;C    length of next month.  4E
          INC    HL          ;                            23
          EX     DE,HL       ;DE now points to next entry. EB
          SBC    HL,BC       ;Subtract a month's days.    ED 42
          JR     Z,CV5       ;Jump to finish if zero,     28 02
          JR     NC,LOOP2    ;else loop until negative.   30 F5
CV5:      ADD    HL,BC       ;Add final month for day cnt. 09
          POP    BC          ;Restore year count.         C1
          LD     B,A         ;B    month of year.         47
          LD     A,L         ;A    day of month.          7D
END:      POP    DE          ;Restore                     D1
          POP    HL          ;D E H L registers.          E1
          RET                ;Return.                     C9
FEB29:    LD     B,02H       ;B    Month no 2 (Feb).      06 02
          LD     A,1DH       ;A    29th day of month.     3E 1D
          JR     END         ;Jump to closedown code.     18 F7
MONTAB:   as for CVDAYS
YEAR1:    LD     DE,MONTAB   ;Point to table of mnth days.  11 XX XX
          DEC    B           ;Count only complete months. 05
          JR     Z,MONTH1    ;Jump if January.            28 09
MONTH:    LD     A,(DE)      ;Length next completed month. 1A
          INC    DE          ;Point to next month.        13
          ADD    A,L         ;Add                         85
          LD     L,A         ;month                       6F
          JR     NC,MONTHS   ;length                      30 01
          INC    H           ;to HL.                      24
MONTHS:   DJNZ   MONTH       ;HL = 365y +d +leaps +M(m).  10 F7
MONTH1:   LD     B,H         ;BC    count of              44
          LD     C,L         ;days since 01/01/01.        4D
          POP    DE          ;Restore                     D1
          POP    HL          ;D E H L registers.          E1
          RET                ;Return.                     C9
```

Andrew uses his calendar routines on his MZ-80K, which he leaves running for weeks at a time. The MZ-80K has a 12-hourly interrupt from the internal clock, to set or reset the AM/PM flag in RAM. Andrew uses this to update the number of days, after having initialised them at switch-on with CVDAYS. He can then get the current date,

whenever required, with CVDATE.

These calendar routines and the clock controller routines from October's Sub Set should bring a software clock/calendar within the scope of all Z80 owners, with the minimal hardware specified for the clock control.

Datasheet

```
:= CVDAYS - Convert Day/Month/Year to days since 01/01/01

;/ CLASS:  2
;/ TIME CRITICAL? No
;/ DESCRIPTION:  Takes a date in the form Day/Month/Year, held
;/               as integers in registers A, B and C respectively,
;/               and converts it to a count of days since a
;/               nominated Day 1 (must be 1 Jan in the first
;/               year after a year exactly divisible by four -
;/               called Year 1).
;/               The routine is accurate for years 1 to 179
;/               inclusive, unless a century year not exactly
;/               divisible by 400 lies inside the range.
;/ ACTION:  To the count of days-into-the-month in HL, adds 365 for
;/          each completed year and 1 extra for each completed
;/          leap year.  Loads A with the length of each completed
;/          month in turn and adds that to HL.  For a current leap
;/          year adds 1 day more if the date lies beyond 29 Feb.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  A 12-byte month table, addressed absolutely by
;/              the routine, must be held in memory.
;/ INPUT:  Day-of-Month in A; Month-of-Year in B; Year No in C.
;/ OUTPUT:  Number of days since 1 Jan in Year 1 held in BC.
;/ REGs USED:  A F , B C
;/ STACK USE:  6
;/ LENGTH:  57 (and 12 for the month look-up table)
;/ TIME STATES:  A reasoned average would be 450 plus 24 each year
;/ PROCESSOR:  Z80
CVDAYS:   PUSH   HL          ;save D E                       E5
          PUSH   DE          ;H L registers.                 D5
          LD     H,00H       ;HL    day of month (=d).       26 00
          LD     L,A         ;test for this being a leap     6F
          LD     A,C         ;year (ie, the least sig two    79
          AND    03H         ;bits = year no mod 4).         E6 03
          JR     NZ,LEAP     ;Jump if not                    20 06
          LD     A,B         ;else test if month             78
          CP     03H         ;Jan or Feb and if it is        FE 03
          JR     C,LEAP      ;skip adding extra day;         30 01
          INC    L           ;if not, add extra day.         2C
LEAP:     DEC    C           ;for no of complete years (y)   0D
          JR     Z,YEAR1     ;jump if was year 1.            28 12
          PUSH   BC          ;Save month & year counts.      C5
          LD     B,C         ;Set loop count = no of yrs.    41
          LD     DE,016DH    ;DE    365 days.                11 6D 01
YEAR:     ADD    HL,DE       ;Add a year's days to HL,       19
          DJNZ   YEAR        ;for each completed year.       10 FD
          POP    BC          ;Restore month & year counts.   C1
          LD     A,C         ;A    years                     79
          RRA                ;completed                      1F
          RRA                ;divided by 4                   1F
          AND    3FH         ;to give the extra leap days.   ED 3F
          LD     D,00H       ;DE    total number             16 00
          LD     E,A         ;of completed leaps.            5F
          ADD    HL,DE       ;HL    365y + d + leaps.        19
```

6502 REGISTER INDIRECT

XYMOD from David Heale of Bolton provides the 6502 with a 6-byte equivalent of the Z80's (HL) type instructions. It can be used to turn any instruction using a 16-bit address operand into one using the value held in the X and Y registers, making available such powerful commands as ADC (XY), CMP (XY), EOR (XY), etc. Perhaps even more importantly, it allows JMP (XY), JMP ((XY)) and JSR (XY).

The routine stores the contents of the Y register in the second byte, and the X register contents in the third byte following JSR XYMOD. The 3-byte instruction executed on return then uses the values copied from XY as the 16-bit address.

For example, if X contains $AB and Y contains $CD then

JSR XYMOD
ROL $FFFF

will become

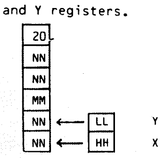
JSR XYMOD
ROL $ABCD

without X or Y being affected. If that piece of code is written in a loop which alters the value of X and Y then a different byte of memory will be rotated each iteration.

I fault the routine for modifying code — the routine itself is ROMable but any code calling it is not. However, each to his own, and any short routine which comes up with 24 'extra' instructions at one throw can't be bad.

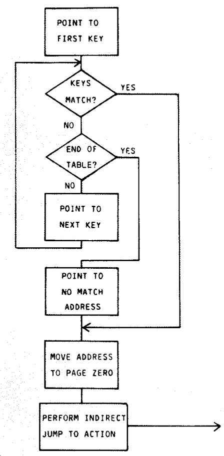
Datasheet

```
;= XYMOD - Modify operand to (XY)
;/ CLASS:  2 (alters code)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Replaces the 16-bit address operand in a 3-byte
;/               instruction following JSR XYMOD with the contents
;/               of the X and Y registers.
;/ ACTION:  JSR
;/
;/XYMOD ADDRESS
;/
;/ 3-BYTE INSTRUCTION
;/
;/ 16-BIT ADDRESS
;/
```




```
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  None
;/ INPUT:  XY contains desired 16-bit address
;/ OUTPUT:  Value of XY replaces 16-bit address in instruction
;/          following JSR XYMOD.
;/ REGs USED:  M1-4, X, Y
;/ STACK USE:  None
;/ LENGTH:  29
;/ TIME STATES:  61
;/ PROCESSOR:  6502

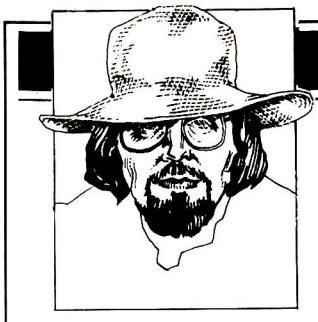
XYMOD   STA  M1       ;Save A                                 85 ZZ
        PLA           ;Copy stacked Return Address - 1        68
        STA M2        ;into M2 and M3                         85 ZZ
        PLA           ;                                       68
        STA  M3       ;                                       85 ZZ
        PHA           ;                                       48
        LDA  M2       ;                                       A5 ZZ
        PHA           ;                                       48
        STY  M4       ;Save Y and use it as index             84 ZZ
        LDY  £2       ;to 2nd byte of 3-byte instruction,     A0 02
        LDA  M4       ;get Y entry value in A                 A5 ZZ
        STA  (M2),Y   ;and put in 2nd byte.                   91 ZZ
        INY           ;Index 3rd byte,                        C8
        TXA           ;get X entry value                      8A
        STA  (M2),    ;and put in 3rd byte.                   91 ZZ
        LDY  M4       ;Restore Y                              A4 ZZ
        LDA  M1       ;and A                                  A5 ZZ
        RTS           ;                                       60
;= CASEOF - Case structure table handling routine
;/ CLASS: 1
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Branches to action associated with matched key
;/               Else to 'no match' action if no match.
;/ ACTION:
```




```
;/ SuBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT: X = search key; M0,1 = case table base address
;/ OUTPUT:  Branch to correct action; M2,3= action address
;/ REGs USED: X, M0, M1, M2, M3
;/ STACK USE: 5
;/ LENGTH: 49
;/ TIME STATES: If match 38 + 35 * key position
:/              If no match 57 + 35 * number of keys
;/ PROCESSOR:   6502

;/ STACK USE:  5
;/ LENGTH:  49
;/ TIME STATES:  If match 38 + 35 * key position
;/               If no match 57 + 35 * number of keys
;/ PROCESSOR:    6502

CASEOF   PHP              ;Save registers                    08
         PHA              ;                                  48
         TYA              ;                                  98
         PHA              ;                                  48
         TXA              ;                                  8A
         PHA              ;leaving input key in A.           48
         LDX   £$00       ;Index to byte 1 (table length)    A2 00
         LDY   £$03       ;Index to 1st key.                 A0 03
TSTNXT   CMP   (M0),Y     ;Test for match and                D1 ZZ
         BEQ   FOUND      ;exit loop if found                F0 10
         PHA              ;else save input key.              48
         TYA              ;Get key pointer and               98
         CPM   (M0,X)     ;test for end of table.            C1 ZZ
         BEQ   ELSE       ;Branch out if end,                F0 07
         PLA              ;else restore key to A.            68
         INY              ;Increment key index to next key   C8
         INY              ;                                  C8
         INY              ;                                  C8
         SEC              ;                                  38
         BCS   TSTNXT     ;and repeat.                       B0 EF
ELSE     PLA              ;Remove stacked input key.         68
         LDY   £$00       ;Adjust index to no match.         A0 00
FOUND    INY              ;Copy address from following       C8
         LDA   (M0),Y     ;two bytes into M2 and M3.         B1 ZZ
         STA   M2         ;                                  85 ZZ
         INY              ;                                  C8
         LDA   (M0),Y     ;                                  B1 ZZ
         STA   M3         ;                                  85 ZZ
         PLA              ;Restore registers.                68
         TAX              ;                                  AA
         PLA              ;                                  68
         TAY              ;                                  A8
         PLA              ;                                  68
         PLP              ;                                  28
         JMP   (00M2)     ;Branch to selected action         6C ZZ 00
```



BANKS' STATEMENT

SELLING SHORT?

Something odd is going on in micro retailing, says Martin Banks.

Right. Time to think of something to write about again. What shall it be this month? IBM and Apple? Well, maybe — after all they are both worth scribbling about at some time or another. What about home computers, the business, the retailers and the numbers? Yes, that's a good area to have a look at. Even though I was never much good at sums, something seems to be not quite right here.

Now, according to all the press reports, handouts and propaganda, the home computer market has gone barmy over the last six months or so. Any company with something approaching a reputation for manufacturing the machines is selling them to retailers like there is no tomorrow. The retailers in their turn are, if the rumours and (no doubt) apocryphal stories are to be believed, fighting off the punters as they stand 15 deep at the counters, all trying to out-bid each other for the one remaining machine left in the shop.

There is one remaining machine left in the shop because, despite the fact the shop is part of a large national High Street chain, and that chain organised a national deal with manufacturer X to supply N hundred thousand systems a month, they have all been sold. Demand, as they say in the retail trade, is high.

Okay, so what happens now? It would seem logical to me that if supplies, no matter how profligate they appear to be, are in practice limited, and if demand, no matter how surprising or unplanned, is inordinately high, the retailers have only one sensible option — screw the price up as far as the market will stand.

I am obviously illogical — a fact that is well-known to my close friends but which, in this context, requires a little explanation.

While recently traversing the distance between my abode and the small intimate Italian nosherama I occasionally frequent at lunchtimes, I took the opportunity to conduct a market survey of an hypothesis: that hypothesis being that high demand and limited supply equals higher prices.

In the course of the stated journey I have to pass two of the high street multiples — D****s and L****s to be precise. In the window of each there were a number of different computer systems commonly sold to the general public. For convenience, I selected just one brand for the potted market survey, so that a true evaluation of my hypothesis could be made. For the record, the selection was the Commodore VIC, though I wouldn't want the company to get big-headed about the fact.

Now the VIC has a recommended retail price of around £150, give or take a yard, and I quite readily assumed that, given the circumstances, many of the retailers would be taking at least the yard in their current pricing.

Nope.

L****s had lopped over £10 off the retail price, while D****s had carved more than £20 away. I was, I must admit, a trifle surprised. What could this mean? Was someone not — dare I say it — telling the truth? Was the demand not there?

Normal free-market retailing logic says that if the outlets are selling a product at a discount it is for two reasons. One is that the projected demand has not materialised and the retailer wishes to get rid of excess stocks. The second is the usually more dubious practice of 'buying a market share', the tactic of trying to shaft the opposition by selling products at a lower price than the rest so that the competition drops out of the business and leaves it all to that one company. This is normally only a valid technique if the company has the resources and long term objectives of operations like 'Japan Inc'.

So, has the demand not materialised? All the evidence would suggest that it is there, even after the Christmas rush, while, before the holiday, purchasers were laying out their money on computers almost on a sight-unseen basis. Commodore was not

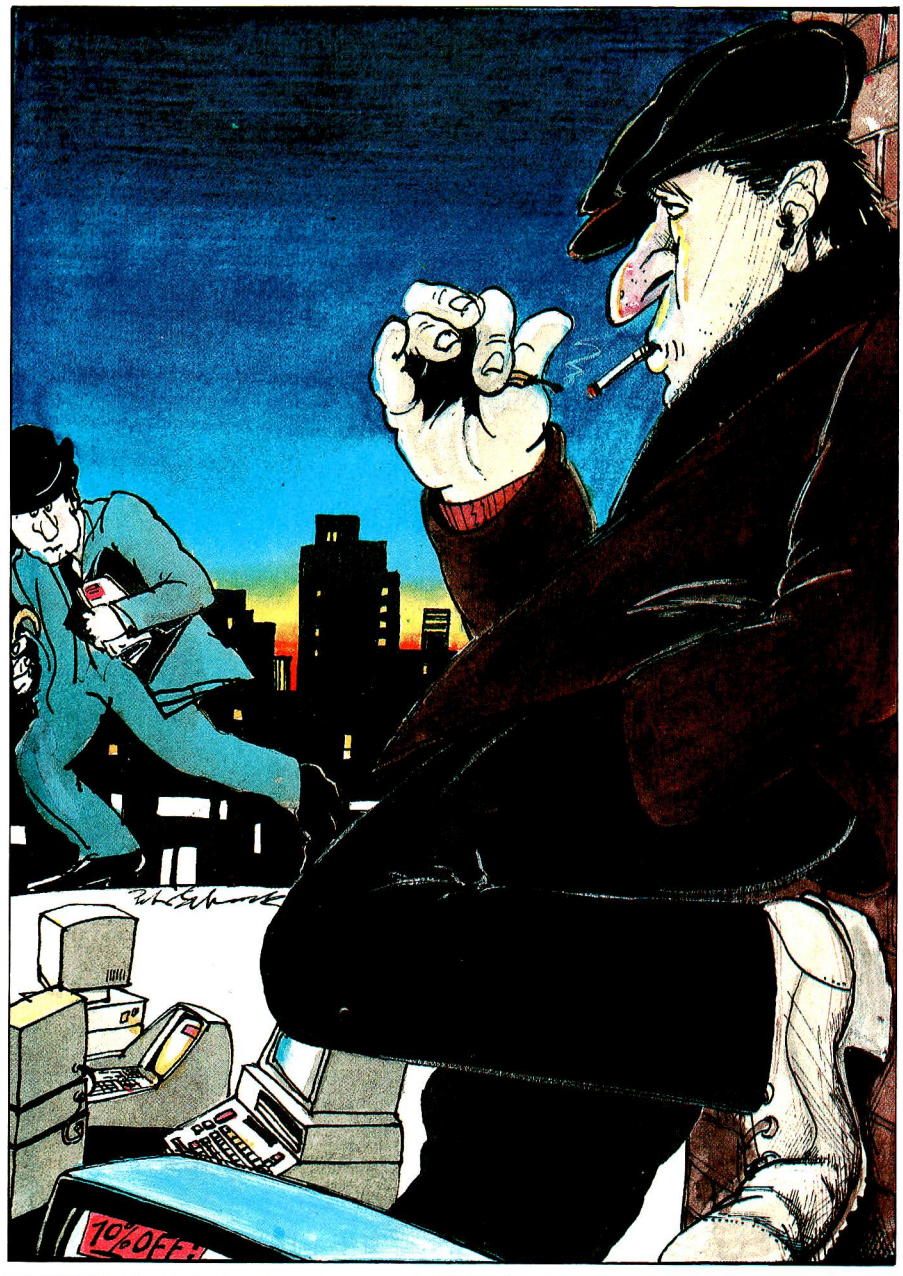


Illustration by Peter Schrank

BANKS' STATEMENT

alone in shipping highest-ever volumes of product in the run-up to Christmas, and claims specifically to have moved 20,000 VICs out to retailers in just one week in November. Like most of the front runners in this business, it is producing systems by the container-load, and is permanently out of stock.

Therefore, the two halves of the equation in my original hypothesis match up. On one side there is high demand by purchasers, and on the other a limited supply (no matter how many machines are manufactured). Such demand-led markets normally have unit price structures that are inclined upwards, not the reverse.

When it comes to the VIC, the subject of my potted survey, a Commodore spokesman said the company was very annoyed at the major High Street multiples discounting the machine. The reasons behind it appear to be interesting.

Though some of them might pretend it is the reason, it is unlikely that any of the multiples are trying the 'buy market share' tactic — none of them have sufficient clout to sustain the level of business necessary at little or no profit for long enough to corner the market. There are also too many different suppliers, many of them new ones looking for outlets, that would be willing to help one of the retailers provide the market with alternatives.

The other reason, and it is one being given a certain credence in some corporate circles, is that the retailers took fright in the Christmas run-up. It appears they really believed that the market might not turn on as quickly as it did, and that they might not be able to sell the vast numbers of 'expensive' products they suddenly realised they were committed to buying.

In response to this fear, it is conjectured, they decided to discount the prices so as to off-load the machines. If there was to be no demand this would be sensible, for it would be cheaper for the retailers to sell the machines at no profit and save on the warehousing charges than try and sell at full price and have to cover those charges.

Given that fear, and the corporate response, the pricing patterns were set at discount. This is all well and good, except that it seems to have been impossible to reverse the pattern once set in motion. The retailers have seemed unable (or unwilling) to respond to demand in the normal way, and push the prices back up. Now this could be because the high street multiples still don't believe that the demand is there in reality, or that the industry has been telling fibs and the demand actually isn't there at all, and they've only been pretending it is.

A third, ironic, possibility is that the retailers' no doubt computer-based internal management, budgeting and accounting systems are not able to cope with a change in pricing structure once it has been entered into the program. Perhaps they should all run Visicalc?

Whatever the reason, the long-term results could be interesting. The first effect has been to please some of the more specialist system dealers, certainly in Commodore's case. They have sold VICs but never liked them too much because the margin is not so great. Now, they are selling their quotas at full price at least, and apparently loving the attention from the marketplace.

The second has been to the advantage of the purchasers — in that, despite the high demand, a little bit of assiduous shopping around, plus a bit of patience, and a computer can be bought for well under list price. Only urgent need for a system should have sent a purchaser to a systems dealer to pay full price for a home computer.

Long-term, the retailers have dug something of a small hole for themselves, for they are now to some extent honour-bound to maintain the discounts they have selected. After all, to sell systems that are in high demand at a discount, with everyone knowing it is a discount, shows they are happy to do it. To suddenly change this policy might appear to the potential purchaser as something not a million miles from an attempted rip-off. They wouldn't do that, would they?

END

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SOFTWARE
DATABASE BENCHTEST

DATA MANAGEMENT TO THE RESCUE?

Kathy Lang checks out a flexible new CP/M package.

Regular readers will know that many of the packages I've reviewed in this series have particular areas of strength that make them well suited to certain areas of data management. This month's offering, a British package called Rescue, which comes from Microcomputer Business Systems and runs under CP/M, is a general-purpose, menu-driven data management package which has much in common with others in this field. But it has unusually flexible provision for different types of information, and its data validation is among the best I've seen.

Rescue comes in three parts: the first deals with configuring the system for your computer, and is not needed again unless you make major changes. The second part covers the creation and amendment of the data files, and of the screen and report formats, while the third permits record amendment and display. This separation makes it easy to set up a system in which most users have access to the information in the files, but cannot change the format of those files or interfere with any provision for protecting parts of the data for security reasons.

Data is stored in fixed-length records in Rescue, but some ingenious methods are used to keep data storage to a minimum — I'll say more about that later. Once you've set up a record format, you can still add fields to the end of the records, but you can't change the sizes of existing fields unless you've made provision for that in advance. (MBS is apparently about to release an option to permit more radical changes to existing files, but it isn't available yet.) You can access the records in two ways. Individual fields may be used as keys, and any one of them used to access a particular record for display and/or editing. You can also select subsets of the data by setting up a set of selection rules, which are used to extract a set of records for browsing on the screen or for printing. You can set up as many screen and report definitions as you please for any set of data; these definitions need describe only a few fields in a record if necessary, and any or all of these descriptions may be password-protected.

Rescue is used through menus, but users can set up their own menus through quite simple procedures. Thus you can set up a series of operations to be activated by one menu option. You can't at present access one file from another, so that the current version of Rescue does not have true data base capabilities.

Constraints

Figure 1 shows the major constraints imposed by Rescue. The maximum record size of 1024 is the same as several others I've reviewed, but Rescue's dictionary capability makes it more economical of data storage than many. Some people will find the limitation of 60 characters in a field more serious. I haven't included in the figure a full list of the field types allowed, as it is very lengthy. Virtually any kind of data format can be expressed with one of the field types provided: I'll say more about them in the next section.

Max no. files in one menu structure	20
Max file size	CP/M limit or disk size, whichever is smaller
Max no. records	32760
Max size record	1024 characters (but good data compression methods)
Max no. fields	100
Max field size	60 characters, 14 digits
Max no. keyfields	10
Field types	See text — several varieties of character, numeric, date (day/month/year), monetary (sterling), dictionary

Fig 1 Constraints

File creation

The process of file creation is shown in Figure 2, which is a 'road map' of all the menus associated with the data definition part of Rescue.

The first stage in file creation involves setting up a data description file, specifying the basic format of each record and the keys it will have. At this stage you must assign a data type to each field. There are four main groups of data: alphanumeric, numeric, date, and dictionary. There are several forms of data type in each group; for instance, character data may be just that and contain any valid ASCII character, or they may be alphanumeric, in which case they may only contain letters or digits and any attempt to enter invalid data will be rejected by the system. There is quite a variety of numeric fields, too, including money (sterling). You can specify that a field is to conform to a mask, to ensure that such items as account references, which often have prescribed formats, are entered in a valid form.

Probably the most unusual type of data is the dictionary field, which permits the person entering data to include only certain values. There are two kinds of dictionary field; a short form, which permits up to 29 characters in total to be used for each field, and a long form, which allows up to 255 entries, each of up to 60 characters. The latter are shared among all the fields in the file, so supposing one has a series of questions each with the same range of answers — for example, answers ranging from Poor to Excellent in a market research survey — you only need one dictionary entry for all the fields to refer to. Each response takes up only one character in the record in the data file for either type of dictionary, so the method is really a way of combining coding with captions for codes.

Every field within the record must also fall into one of four entry categories: mandatory (ie, the field must always have a value), optional (the field may be empty), calculated or display-only. Calculated fields are derived from calculations on constants or on other fields in the same record. Display-only fields are provided so that for certain modes of access fields can be shown but not altered — account numbers might for instance be protected in this way. Any field in a record may also be linked to others in a number of ways.

Direct linkage provides for situations where some fields only have values if another field — said to be the controlling field — has a certain value. For instance, details about a property might say if the property were freehold or leasehold, but only if it were leasehold would it be sensible to ask for the life of the lease and the annual charge. This approach can also be used to deal with records with lists of information; you might want to store the names of all a person's children, where some people might have as many as six, without asking six questions about childless people. Most packages expect you at least to hit one key for each question when entering data from the keyboard, but with the Rescue approach entry can be more finely tuned to stop prompting for answers if they are not needed.

During file definition you must also specify the fields which are to be used as keys. Rescue treats the key field which is physically nearest to the beginning of the record as the main key, in that you have to ask specifically for other keys when you come to access the file; so it can save a little time to think about what order to store fields in the record. Up to 10 fields may be defined as key fields. Keys may be either unique or duplicate, and Rescue checks when supposedly unique key values are entered. All the key fields are referenced from a single index, which is automatically kept up to date when data is added or amended.

The next step is to define screen and print formats for the records; you can have as many of these as you wish, and each may describe only parts of the record — for instance, to prevent confidential information being seen by everyone. Next, you tell Rescue to set up an empty data file and structure the index file, and finally you construct any custom-defined menus you will need. If you do specify more than one screen or report definition, then you will have to do some customisation of the menus in order to use the alternative formats, but this is quite a straightforward process.

Input and editing

The provisions for data validation given by the dictionary facilities, by the variety of data types and by the range checking which can also be set up at file definition time, are extremely powerful — it's always possible to get the data wrong in a logical sense, but Rescue makes it quite hard to get it wrong in any other sense. That said, I did find the mechanics of correcting data a bit clumsy; if you've made a mistake and go back to edit a record, you can say where in the record you want the editing to begin, but from there you must work sequentially through — you can't work back up the screen either when entering or editing data. Since the program requires you to have a terminal which can move the cursor left and right, it seems a bit strange not to utilise cursor movement up as well, since no terminal is likely to have horizontal movement but not vertical . . .

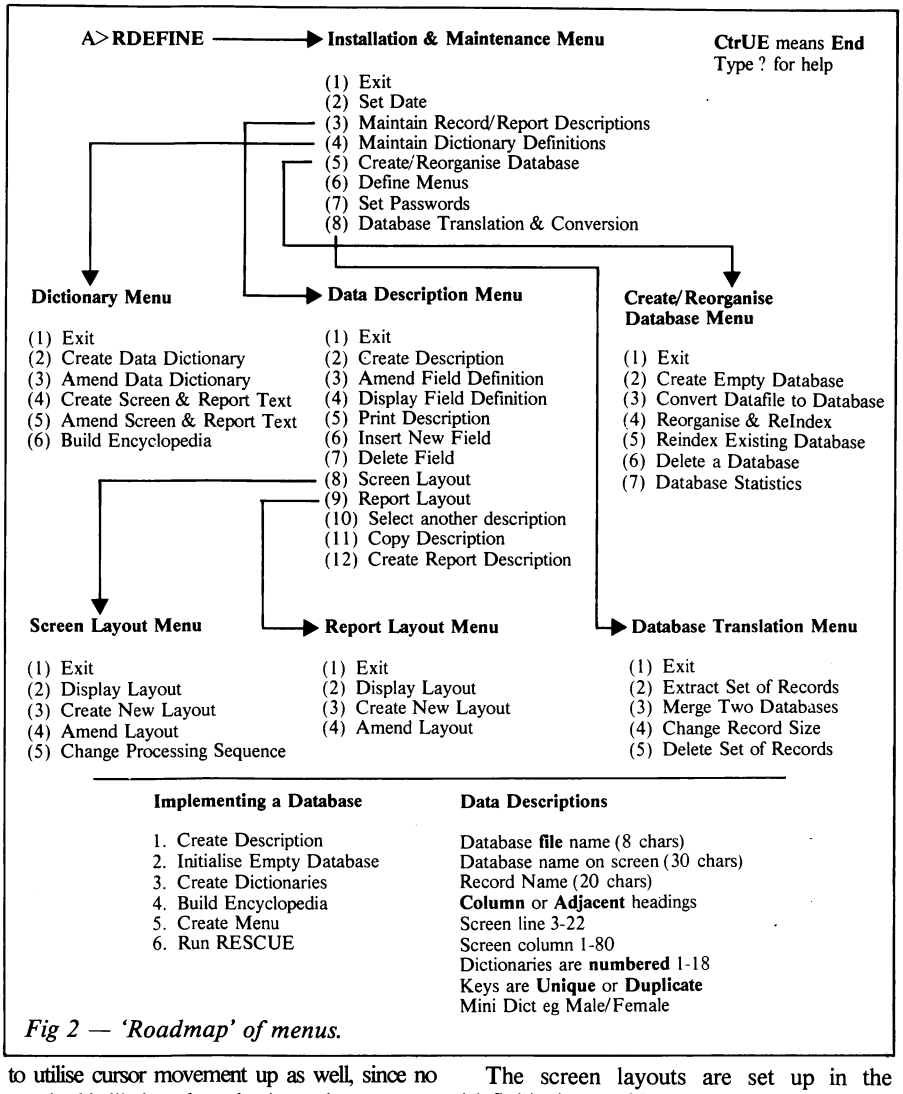

Fig 2 — 'Roadmap' of menus.

When you retrieve records for amendment, you do so by specifying a particular key value; you can specify the use of any key, but you have to get the value of the first four or five characters exactly right (except that Rescue is 'case-blind' in this situation, so it will for instance match Smith and smith). Even when matching exactly on a key value you may retrieve more than one record, as duplicate keys are allowed. But searching for field values within ranges is only possible when you want to look at records, not when you want to change them.

Screen display

I said that you can have several definitions for a single file, so that records can be displayed on the screen in different ways for different users or applications. These screen definitions can be created by copying existing definitions and amending them, but I couldn't find a way to see what definitions I already had except by going out to CP/M and using the Directory command. Screen layout is specified by giving row and column coordinates for each field you want to display, which I found much more difficult to use than the 'paint-a-screen' approach which has become fairly common. The coordinate approach also makes it more difficult to amend the layout, though Rescue does have one provision to make this a little easier by letting you specify a re-ordering of the display without changing the absolute coordinates.

The screen layouts are set up in the 'definition' part of Rescue. However, they are invoked from the main part of Rescue, through executing one of the options in the menus shown in Figure 3. Display can be of records specified either by matching one key, or by selection using the selection and extraction procedure which is described later.

Reporting

Rescue uses the same mechanism for printed reports as for screen display, so both are strictly record-based. The only provision for aggregated information is totalling of numeric fields. It is possible to force page-breaks when values of particular fields change, but sub-totalling is not provided. There is, however, a very flexible facility to interface with Wordstar and Mail/Merge, so it is easy to use them in combination with Rescue to write circular letters and concoct sets of standard paragraphs.

Selection

Rescue provides the ability to select parts of the data file for browsing, printing or further selection. The main method of doing this is to set up a set of selection rules in a file, and then to apply these to the data file to produce another file containing the selected records. The selection rules are very flexible: you have all the usual comparison operators (less than/greater than/equal to/not equal to) and data values can be compared with constants or with the values of other fields in the same record. Rules can be combined to provide ANDing and ORing within and between

DATA MANAGEMENT TO THE RESCUE?

fields, and these combination facilities together with the NOT operator make it possible to select virtually any combination of values you could need. However, personally I don't like the need to set up rules in a file, as it is rather cumbersome in practice; if you are using the standard facilities menus you must go to the 'Maintain Rules' menu (at the third level of menus), create the rules, then go back to the first level of menus and down to the third level 'Extract and Sort' menu to actually extract the records you need. Finally (from the same Extract menu) you can display or print the records that have been found. This provides a sharp contrast to the command language approach, in which one command will extract your records and a second at the same level will display them. However, you could tune the menus in Rescue to avoid some of this ponderousness, so it's better in that sense than menu systems which you can't adapt.

While actually comparing fields, upper and lower case letters are regarded as equivalent. You can use wild codes: ? will match any one character, * will match one or more characters. For dictionary fields, the order for comparison purposes is the order in the dictionary, so if you have a set of answers with Poor as the first and Excellent as the last, Poor will be regarded as 'less than' Excellent, even though P comes after E in the alphabet. This is usually what you want, and with much coded data would be a very valuable feature.

Sorting

Rescue can sort a data file on up to five fields in one operation; the process is similar to selection, and you can also combine selection and sorting to give a sorted extract file. Sorting is either in ascending or descending order; as with selection, dictionary fields sort in their dictionary order (Poor before Excellent) rather than in alphabetical or numeric order. In addition, ordinary character fields can be given a sort value which is different from their simple alphabetical order. This could be particularly useful where you had fields such as book titles which often have prefix words such as A or The, which you want to ignore for sorting purposes but wish to include as part of the field for printing. (In most packages these prefix words must occupy a separate field, which will be empty for titles without a prefix word.)

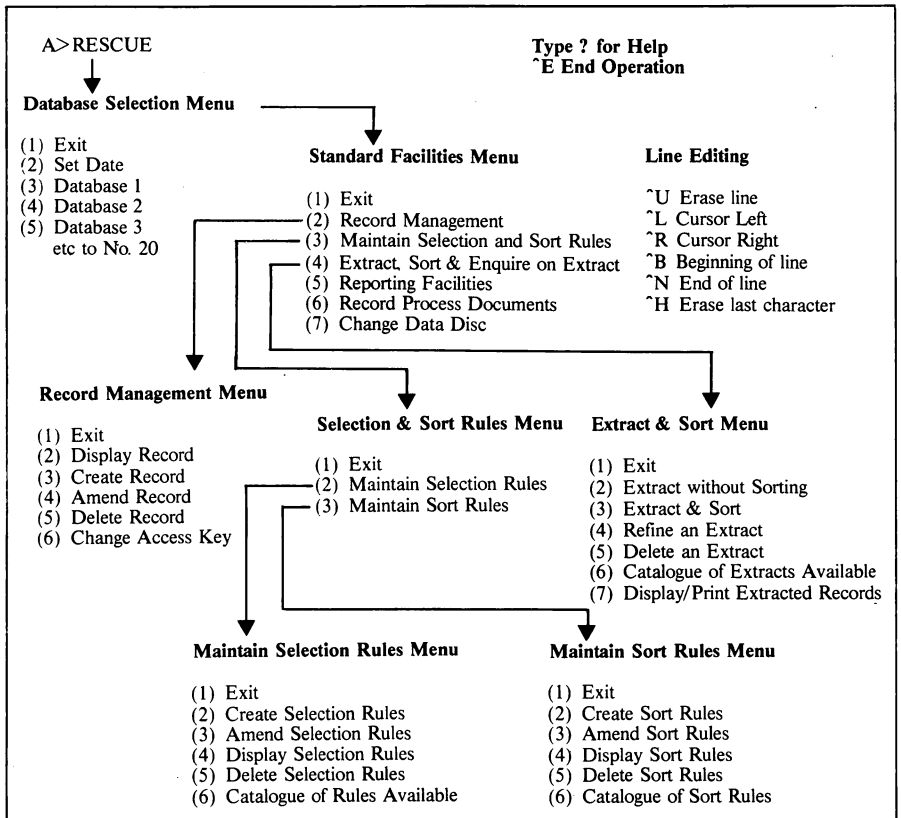

Fig 3 Menu options

Calculations

The calculation facilities in Rescue are quite powerful in the input phase, and practically non-existent after that. When you set up a data definition file, you can specify that a field is to be calculated from constants, or from combinations of other fields (including dictionary fields) in the same record. All the usual arithmetic operators are available. After input, the only calculation you can request is totalling on printed reports; this is activated by requesting totalling of a field when a description file is set up. Up to 10 fields in any one description file may be set to be totalled.

Security

Protection in Rescue is of two kinds. It is possible to take the programs used in the Define stage off the run-time disk, so that the ordinary user can use file definitions and screen and report formats, but not amend them. At a more detailed level, password protection can be provided for particular data files, for individual description files (so that a user can be given access only to part of the data in a file) or for particular menu items in custom-built menus (so that some users may have access to some functions but not others, while other users have greater facilities, but all within one menu). This is a flexible and powerful scheme, and should provide for most needs.

Stability and reliability

I didn't have any problems over reliability with my use of Rescue. As to stability, new versions of Rescue, which are 'cost options', are intended to be compatible with existing versions. New features in the pipeline include a version for MS-DOS and a multi-user version.

Tailoring

As usual, the first task is to tailor Rescue for your particular terminal. This appeared quite straightforward (although, as is the common bad practice, you can't be sure the tailoring has worked until you actually run the main Rescue suite). However, I had one misunderstanding which I never managed to sort out; this resulted in repeated prompts being printed on the same line as the error messages, which were thereby overlaid so that I couldn't read the error message. I wasn't able to discover whether this was an error in the software, the documentation, or my interpretation of them and my Sirius manual, but it hasn't happened to me before. While tailoring for the terminal, you can tell Rescue about cursor movement left and right, but not about which keys move the cursor up and down, so much potential editing flexibility is lost.

Once into Rescue, the main tailoring facility is the ability to set up sequences of activities

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on custom-defined menus. This gets round some of the inflexibilities associated with menu-driven systems, and I found the approach quite easy to use.

Relations with outside

Rescue can write files in standard ASCII characters, using the 'comma delimited' format required by many other packages including specifically Wordstar's Mail-Merge option. Thus you can set up files of information which you want included in circular letters or standard paragraphs, and then fire them off to Wordstar or another similar package. Within Rescue you can include on a menu the ability to run another program, so it would be possible to tailor a menu to carry out a selection/printing sequence of this kind, called by Rescue 'record processing', without the user having to go back to CP/M. You can't at the moment read external files of ASCII records into Rescue, though there is a menu option to do this already shown, which I'm told will be implemented in the very near future.

User image: software

Once again, your overall reaction to Rescue will be governed by whether you like menu-driven packages or not. I found the ability to tailor menus to provide facilities oriented to particular requirements a big help in mitigating the inflexibilities of menus. However, most users are likely to follow the well-established principle of 'satisficing' (a word coined by Herbert Simon, the psycho-economist, to describe the tendency to accept adequate or satisfactory results rather than go for the best possible) and only set up extra menus when they absolutely have to, for instance to access alternative screen layouts. So I suspect that mostly people will use the rather cumbersome standard menu facilities. I also had a rather mixed reaction to the complete separation of description of and access to the data files. Within an organisation which has a 'data base administrator' (who might simply be the boss in a small business) this could be a useful separation for security reasons, but it would be less helpful where the same person organises the data files and puts information into them, perhaps in a small office, one-person business, etc.

Within the package itself, I as usual found some goodies and some nasties. The progress through the menus was orderly and logical, and was made straightforward by the provision of the two 'road maps' which I show as Figures 2 and 3. The process of prompting was easy to understand. It would have been even easier if, when a question has a default response, this was displayed before the question is posed — in many cases the default is not shown even after you've accepted it, unless you go back and edit the record concerned. Allowing the use of identifiable abbreviations, both for field names and for data values, is sensible.

I didn't like the use of row and column coordinates when formatting screen displays and printed reports, especially as there is no default format, so you always have to supply one. The 'paint-a-screen' approach is much easier in general than coordinate specification, and if this is not supplied then there should at least be a default format with records displayed one field per line starting at the left of the screen or paper. I also found the inability to move back within a record when editing a real nuisance.

Documentation

The manual is basically a reference document, but written in so much detail that it could be used to teach yourself about the package if you were reasonably familiar with data management terminology. However, the amount of detail makes it rather difficult to find your way around. Two goodies help a little in this: the use of emphasis within the text to call the reader's attention to the most important parts of each section, and the printing of chapter headings right-aligned on each page (a real help to browsing at a general level). But the chapter names didn't always make it easy to guess where a particular feature would be described, and since there was neither a detailed table of contents relating to each chapter nor an index, it was very hard to get from 'now I've seen something about that feature somewhere' to the exact part of the manual in question. Part of the remedy is close at hand, since if the 'road maps' (which perform most of the functions of a reference card) were annotated with the numbers of the sections documenting each menu item, readers would find it very much easier to locate the particular piece of information they need fast. (As this article went to press, MBS issued an index for the manual, which should help.)

The other problem I had was that, while each feature is documented in detail with examples of the particular feature, there are no examples of the display or use of groups of features. For instance, all the features of data entry are described in turn, but there is no figure showing how data definitions are displayed on the screen. Nothing bolsters a user's confidence like some complete examples shown in real screen pictures!

I can't resist ending this section by awarding MBS second prize so far in this year's contest for manual typo errors, with 'Data Validification'.

BM1	Time to add 1 new field to each of 1000 records	Setup time
BM2	Time to add 50 records interactively	Scrolling time
BM3	Time to add 50 records "in a batch"	NA
BM4	Time to access 50 records from 1000 sequentially on 25-character field	1 min 20 secs
BM5	Time to access 50 records from 1000 by index on 25-character field	NA* (1-3 secs)
BM6	Time to index 1000 records on 25-character field	12 mins
BM7	Time to sort 1000 records on 5-character field	4 mins 10 secs
BM8	Time to calculate on 1 field per record and store result in record	NA
BM9	Time to total 3 fields over 1000 records	NA yet
BM10	Time to import a file of 1000 records	NA yet

Note: NA=Not available NA*=Not available exactly as tested — key must match exactly

Fig 4 Benchmark times

Costs and overheads

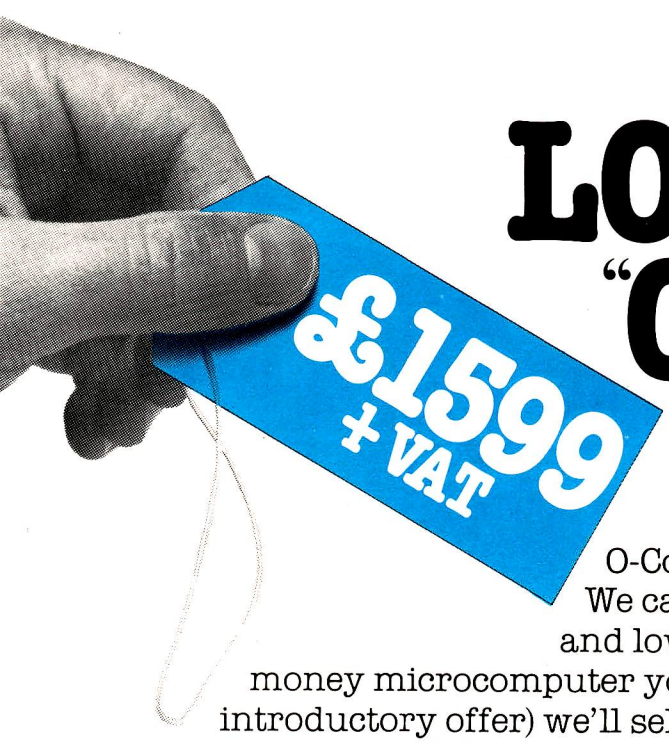
Rescue costs £295, and is available from MBS (telephone 01-253 3998). To be realistic, you would need a disk system with the regular double-sided, double-density capacity of 370 kbytes per drive on a two-drive floppy disk system, to enable you to have all the Rescue software on one disk drive and use the other for data. I found the system very slow in loading individual program modules, which seemed to happen whenever I changed from one sub-menu to another. I was told that this was specific to the Sirius-Z80 card method of disk access, but I haven't noticed the problem with other packages I've used. The times for actually running the Benchtests are shown in Figure 4. (Details of the tests were given in *PCW* December 1982.)

Conclusions

Rescue provides data management facilities through individual files. Data description facilities are very powerful; Rescue provides a variety of data types and validation features more extensive than any I have found before. These features also help to make Rescue much more economical on data storage than is usual in programs which use fixed length records. You can select and sort the data to provide pretty well any required subset, but the process is rather cumbersome. Screen and report formats can be varied according to the needs of particular users, which makes it straightforward to protect particular data items; you can also permit users access only to certain Rescue features. Screen and report formats are described in a rather rigid way, and there are no default formats for easy initial use.

On the other hand, the ability to send data to and run Wordstar's Mail-Merge option from within Rescue could be very valuable in some environments. Apart from the calculation features on data entry, the only calculating power within the package is the ability to total particular fields. The system is menu-driven, which can be ponderous in use, but you can if you wish design your own menus to mitigate this disadvantage to some extent. Rescue is in the main a single-file system — you cannot reference one file through data values in another. Provided this limitation is not a problem, you would find Rescue worth investigating, particularly if the variety of data types and the extensive data validation would be beneficial in your application.

END



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THE REALLY VERY FRIENDLY COMPUTER

FILING THE FILLINGS

Michael H Rich describes how micros can help improve dental health.

Using any kind of computer in a dental practice neatly divides itself into two compartments: use in the office, which is comparable to using a micro in any small business, and use for clinical records. This latter use involves a far wider concept than 'ordinary' business use as the software is highly specialised and, as will be described below, needs the use of combined graphics and text on the screen to be fully effective.

Before the advent of the microcomputer there was very little hard/software available for the dentist to be able to introduce computerisation into a dental practice.

What there was was in the nature of a large 'mini', complete with the necessity for an air-conditioned 'cubicle' for the CPU which used fixed/removable hard disk cartridges. This, of course, allowed a multi-user facility but in the context of a small dental practice was far too expensive to be cost-effective.

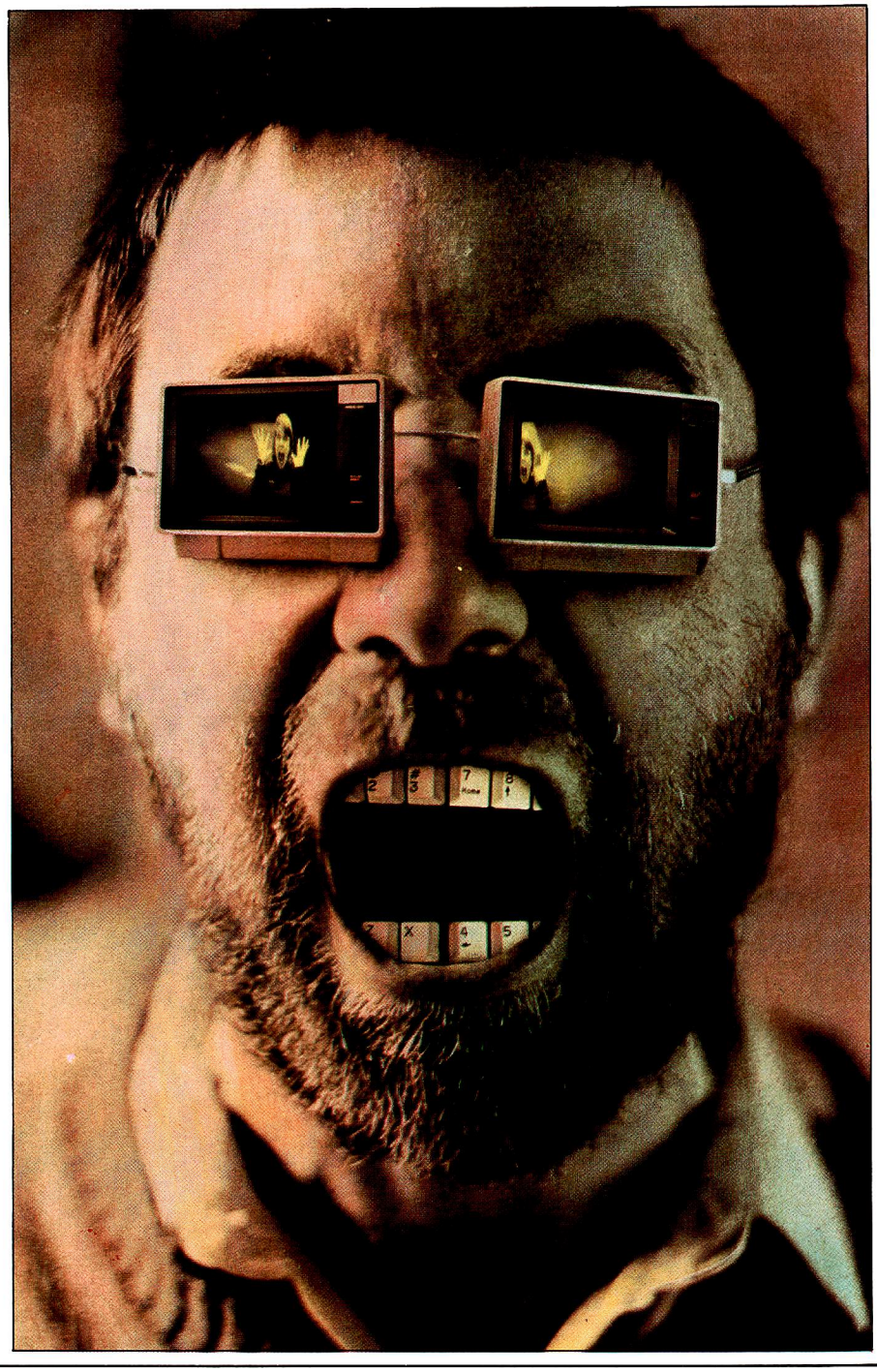
Minicomputers are still available for dental practices; they are smaller in size as well as being slightly cheaper in price, and the suites of software with these systems do a reasonable job of helping the dentist to run his practice. The argument about being cost-effective still applies and thus they are for the larger practice only.

The micros of the Apple/PET/Tandy variety (and this list is by no means exhaustive) have, of course, opened up the world of computerisation for the small business, and it should be realised that a dental practice is precisely that. Many of the available software packages for running such a business can be applied to a dental practice. The management of accounts can be dealt with in a standard manner, as can stock control; although a practice employing half a dozen people hardly needs payroll software!

What distinguishes the dental practice from a small business is the clinical aspect of treating patients and the paperwork that this generates. When examining patients a dentist records the clinical information derived from the teeth in a form consisting of various shapes to designate types of cavity, fillings present, teeth to be extracted, dentures present and a variety of other conditions. This pictorial representation of a mouth is easy to scan and assess and is an internationally standard method. To record this information in written form, although suitable for a standard database software package using routine file handling procedures, would be very long-winded and would mean abandoning the standard procedures used.

There is software available for use on micros which does do this graphic charting of the clinical conditions in a mouth and this is allied with space to write clinical notes of treatment to be done, or which has been done. This is often conjoined with a suite of programs which will price the work done, whether under the NHS or privately, and will produce bills for patients and carry out the usual reconciliation with payments, aged debt analysis and so on. The software will often include a facility for routine recall of patients at a standard time interval and this raises the other major aspect of the application of computerisation of a dental practice — the appointment book.

It is necessary to realise that anything other than the appointment book in a dental practice is capable of being replaced or renewed in the event of a complete disaster, eg, a fire. To take an extreme example, if the premises are totally destroyed one can set up a tent with a telephone line outside the front door and with a list of patients due one can reconstruct records and re-schedule appointments until the premises are fully functional again. Without this book a dentist might as well go home. Consequently a dentist has to consider very carefully whether to commit this vital aspect of his/her practice to an electronic form which may be subject to the vagaries of an irregular power supply, corruption of storage



media and the sundry other faults which can occur. To back up one's records every time a fresh appointment is made or one deleted from the 'book' would be counter-productive in terms of time even though it is essential if the possibility of either missing a vacant time slot or double-booking is to be avoided. An actual appointment book can be kept in a fire-proof safe for peace of mind.

In addition to this, the software available at present for this function will only display, at best, one day per VDU screen (some only half a day) per dentist. A good receptionist can keep a visual image in mind of the black spaces in an actual book and can turn a page to 'bring up' a whole week at a time much quicker than any software can on a screen.

To go back to the function of computer-isation of clinical records, one has to realise that for this to be fully effective there has to be a terminal and screen in each surgery with central mass storage as well as a terminal, etc, at the front desk. This again raises the question of cost: even using micros for only two surgeries and reception on this basis with, say, 10Mb storage will put the cost towards the five-figure mark, which becomes very expensive in the context of a small dental practice. The actual storage figures for dental records with chartings for each patient may be in the range of 500-700 bytes per patient per course of treatment and this multiplied by approximately 3000 patients per dentist gives some idea of the basic storage needed to keep clinical records. Details of treatment have to be kept for at least two years after completing a course of treatment and this, allied with all the other office functions needed, suggests that the 10Mb mentioned above could be a conservative estimate for a practice containing three or more dentists.

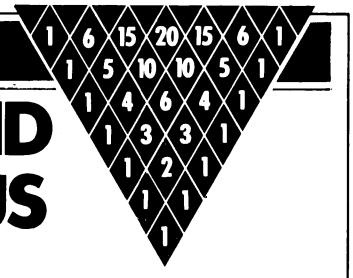
The other main problem concerning dentists at the present time is the possible computerisation of the NHS claim form FP17. This is a complex form which has to be filled in accurately so the dentist can be paid by the NHS. It contains details of the patient; name, address, clinical charting grid, a minimum of seven different dates to be filled in and various other details. Software has been written to cope with this so it can be printed out after the data has been put in from the handwritten clinical notes. The problem with this is that the slightest change in the format of the grids, etc, on the FP17 would mean rewriting this software. A suggestion has been made that the central collating body for these forms could use 'light pens' to read any printed codes produced by any printer, enabling a dentist to use whatever internal record system is desired. This problem still has to be resolved and will depend on whatever change in method of remuneration of dentists may be applied in the future.

The only other main office function for which a computer is often used and not yet mentioned in connection with a dental practice is the use of word processing. This is not generally a great necessity in a dental practice. Recalling patients every six months is often a feature of a dental software package and would incorporate a print-out (hard copy) format.

In summation, one can state that the small system with a couple of disk drives, screen and printer (not necessarily of letter quality) with a good database software package at about £3000 is a viable proposition for even the single-handed practitioner. The limitation of use to office procedures only is still worthwhile, even solely on the basis of eliminating lots of pieces of paper. Clinical records require considerable mass storage, sophisticated software and even provision in the actual surgeries to accommodate the extra terminals needed.

END

NUMBERS COUNT



POWERFUL NUMBERS AND A PROBLEM OF STEINHAUS

Mike Mudge poses another problem for mathematical wizards.

The positive integers consist of 1,2,3,4,5···; these are each ordered sequences of the ten digits 0,1,2,···9. When n denotes a positive integer the product of n-factors each equal to x and called the n-th power of x is written x^n. Thus the fifth power of three is written $3^5 = 3x3x3x3x3 = 243$.

Given two positive integers n and k, a third positive integer, denoted by $p_n(k)$, may be defined as the sum of the n-th powers of the digits of k — eg, $p_3(271) = 2^3+7^3+1^3 = 352$.

A positive integer, k, which is equal to the sum of the n-th powers of its own digits is called a Powerful Number (PN) of degree n. It is defined by $p_n(k) = k$. Note: 1 is a trivial PN for all k since $1^k = 1$. For example, if n = 3 the PNs are given by

$153 = 1^3+5^3+3^3 = 1+125+27$
$370 = 3^3+7^3+0^3 = 27+343+0$
$371 = 3^3+7^3+1^3 = 27+343+1$
$407 = 4^3+0^3+7^3 = 64+0+343$

while if n = 10 there is known to be only one PN.

$467\,930\,7774 = 4^{10}+6^{10}+7^{10}+9^{10}+3^{10}+0^{10}+7^{10}+7^{10}+7^{10}+4^{10}$

The name 'Powerful Number' is due to J Randle, *The Mathematical Gazette,* Vol III No 382 December 1968, while the number of non-trivial PNs corresponding to each n <= 10 is reprinted here from M R Mudge, *Computer Bulletin,* II/33, September 1982.

n	3	4	5	6	7	8	9	10
Number of PNs	4	3	6	1	5	3	4	1

The Steinhaus Problem

Professor Hugo Steinhaus of Wroclaw, Poland has denied being the originator of the following problem, although it carries his name throughout the literature.

What pattern of digits is determined by repeating the operation of summation of the n-th powers of the digits from an arbitrary initial value k?

Special case n =2 (A Porges). A set of eight numbers, *American Mathematical Monthly* 52, 1945. From an arbitrary initial value k one either reaches the trivial PN 1 or enters the loop of length 8 given by 4 16 37 58 89 145 42 20.

Special Case n = 8 (I Takada). 'Computation of Cyclic Parts of Steinhaus Problem for Power 8', Mathematical Seminar Notes of Kobe University 7, 1979.

From an arbitrary initial value k one either reaches the trivial PN 1, one of the non-trivial PNs 24678050, 24678051 or 88593477, or enters the loop of length 3 given by 54642372 7973187 77124902 or a unique loop of length 25 or a unique loop length 154.

It should be noted that the total CPU time for analysis of this problem is quoted by I Takada as 216.6 seconds on the NEC ACOS-6 Fortran system at Kobe University.

Problem

Submit a program which investigates the pattern of digits determined by repeating the operation of summing the 8th powers of the digits from the initial values of 2 and 3 —these leading eventually to the Takada loops of length 25 and 125 respectively. Extend the knowledge of the Steinhaus Problem by commencing an investigation of the 9th powers in particular generating the four PNs referred to in the above table: each has nine digits.

All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A prize of £10 will be awarded to the 'best' entry received within two months of the appearance of this article.

Submission to: Mr M R Mudge BSc, FIMA, FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Submissions will only be returned if suitable stamped addressed envelopes are included.

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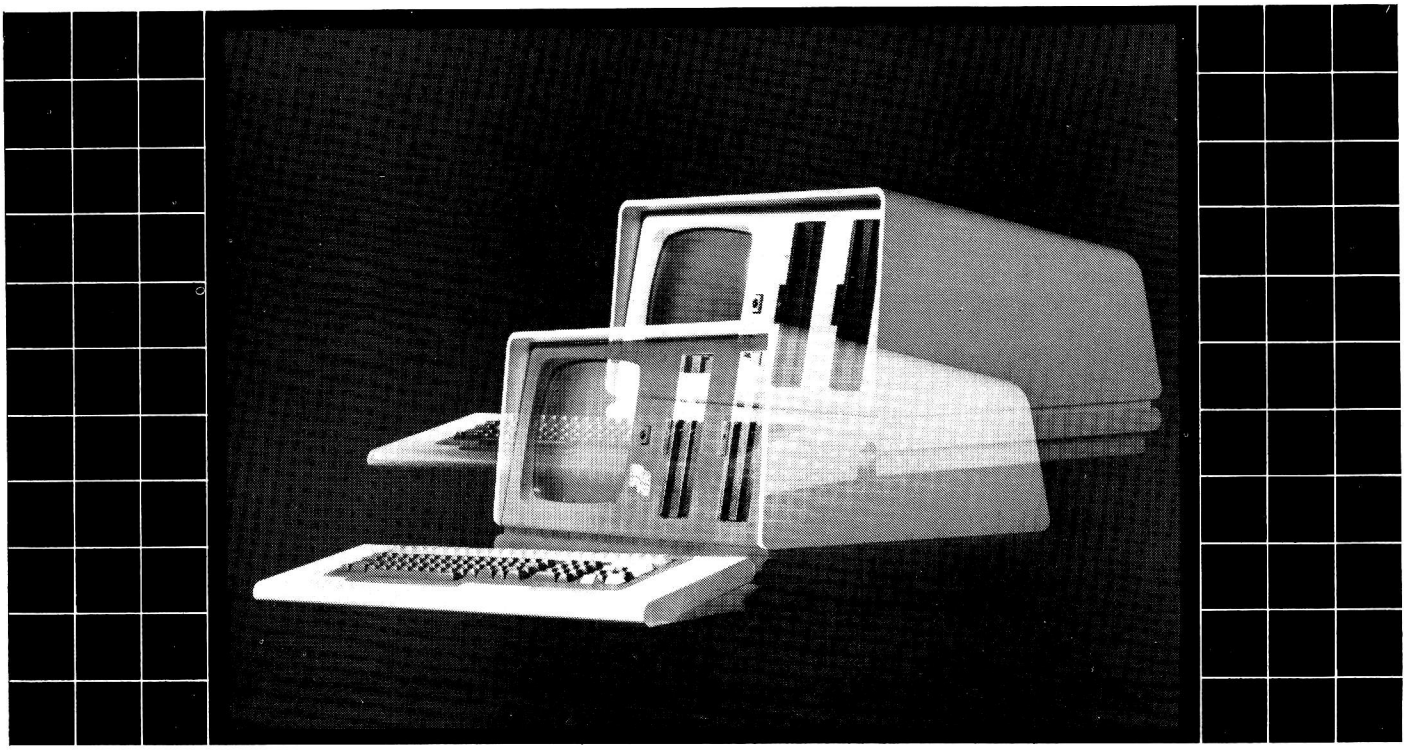

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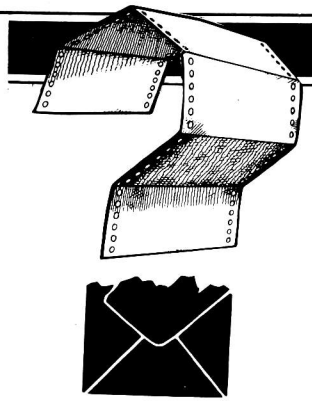

COMPUTER ANSWERS

Send your queries to Len Warner, 35 St Julian's Road, St Albans, Herts. Please note that Len cannot answer questions on an individual basis, so please don't send an SAE with your query.

C for communication

I wish to download software I have developed on an Onyx C8002 to a Superbrain for testing under CP/M. I am a little unsure of how to write the driver software in C to handle the communication between the two machines' IEEE ports. I should be grateful if you would recommend any books I could read to help me solve the problem.
H Frost, Shepperton, Middlesex.

For the C language used for the driver program I would recommend *C Programming Language* by Brian W Kernighan and Dennis M Ritchie, obtainable from Lifeboat Associates, PO Box 105, London WC2H 9LU. One of the best books on CP/M that I know is *The CP/M User's Guide,* published by McGraw-Hill/Osborne. *The CP/M Handbook* by Rodney Zaks (published by Sybex) is also excellent, although not going into the inner workings of CP/M to the same extent. The Digital Research CP/M handbooks are also essential for your project, but I expect you are familiar with these.
P L McIlmoyle

Scoring with Alf

I have heard that there is available a micro that can not only play a tune, but can also print out the music onto manuscript paper. Can you please tell me more about it?
A P Hawkins, Camberley, Surrey

The system you have heard about might well be the Apple II computer fitted with an Alf Products MC16 or MC Music Synthesiser board. This provides facilities for composing music on screen, and displaying it in full musical notation. The resultant music can then be played through the user's external audio system. By using a high-resolution graphics printer like the Epson MX100 it should also be possible to print out the music score, screen by screen. Details of the Alf synthesiser boards are in *PCW* May 1981.
P L McIlmoyle

m/c — more complex?

I have heard a lot recently about games being better in machine code than in Basic, but because I have only recently come into the world of computers I have yet to grasp fully what machine code is, why it is faster and most importantly, how I get to use it. Also, are there any drawbacks to using it?
Leslie J Lauw, Ongar, Essex.

Machine code is the language that the computer itself understands directly. Languages such as Basic have to be converted into machine code before they work. This means that a) you have more direct access to the computer itself, and b) time is not wasted while converting from another language to m/c. Using m/c is not particularly difficult, though the most convenient way of entering your own programs is via an assembler, which converts the m/c mnemonic into its respective hex codes (the form which the computer can execute) and then puts them into memory ready for easy access. The only drawbacks are the facts that some more complicated operations such as floating-point arithmetic are rather difficult unless you know how to access the FP routines in the ROM of the computer you are using (this isn't usually too difficult). Also m/c is a little less easy for the beginner to understand, but with the aid of a good book it isn't really that hard.
James Walsh

Forth facts

I have taken an interest in the Forth computer language, after reading the article 'Go Forth and multiply' in the December 81 issue of *PCW*. Can you recommend some books on Forth and tell me where I could obtain them?
(Name withheld by request)

The best introductory book on Forth is *Starting Forth* by Leo Brodie of Forth Inc, published by Prentice-Hall. For more detail on an implementation of Forth, the book *Threaded Interpretive Languages* by R G Loeliger, published by Byte Books, describes the development of a Z80 Forth system.

Both these books are available on mail order from: Mine of Information, 1 Francis Avenue, St Albans, Herts AL3 6BL, at £12.90 and £15.90 respectively (phone St Albans 52801 to check availability), or from Comsol Ltd, Treway House, Hanworth Lane, Chertsey, Surrey, KT16 9LA, at £15.60 and £18.50 each.

Just published by Wiley is *The Complete FORTH* by A T Winfield, but I have not yet seen a copy. The price, however, is very reasonable at £6.50.
John Yale

Easy deletion

I have recently started to use an Osborne 1 portable microcomputer, and am generally impressed by it. The keyboard is not as solid-feeling as I would like, but must obviously be light for portability. However, there is one curious and awkward omission, which is the lack of a DEL (or RUBout) key. This is particularly frustrating when using WordStar, as deleting the character just typed then needs Control-S to backspace, followed by Control-G to delete the character the cursor is then on, rather than just pressing DEL. Is there anyway to provide a DEL function on this machine.
(Name and Address withheld by request)

There are in fact at least two ways to overcome this problem. The first is to make use of the ability to program the numeric pad keys to generate the ASCII code for DEL (7F hex).

Alternatively, and much simpler, pressing Control together with the minus sign key will generate DEL.
P L McIlmoyle

Simple sidescroll

Recently I saw a program running on a BBC microcomputer that appeared to scroll the screen sideways! I am intrigued by this — how is it done? Whilst on the subject of the BBC micro, how can I be sure that programs written on my 32k machine will still run on a 16k machine?
Nick Parker, Enfield

As you will see from this simple program below, scrolling the screen sideways is very easy. You simply alter the parameter X in the VDU 23 command here: VDU 23;13,X,0;0;0;

```
10 FOR X=0 TO 100
20 VDU 23;13,X,0;0;0;
30 Q=INKEY(10)
40 NEXT X
```

(Line 30 is simply a delay).

You could also refer to

'Accessing the 6845' article in the December issue of the BEEBUG magazine.

To answer your second question, there is a built-in *FXcall to simulate a 16k machine; thus you can even simulate a 16k disk-based machine. Typing *FX 254,1 followed by Control and Break together will give you a 16k sign-on messsage. To return to normal use *FX 254,255, followed by Control-Break.

BEEBUG — Independent User Group for the BBC Microcomputer.

Tan RAM

I need some 2114 RAM chips for the Tanex board on my Tangerine Microtan. What sort are suitable? For instance, could I use 450 ns low power chips?
J Strutt, Epperstone, Notts

Generally speaking, it is important to make sure that the speed of the chips, as well as the reference number, is appropriate for your application. As the Microtan uses a 6502 CPU, the 450 ns should be perfectly adequate. Low-power chips are unlikely to be needed unless you are running off batteries, or have an inadequate power unit. However, they would certainly do no harm in your Microtan, and could be regarded as a bonus.
P L McIlmoyle

Medical examination

I am considering a computer in the £200 range for some medical and financial applications, So far I have narrowed the choice to the Newbrain model A, and the Sinclair Spectrum (48k).

The Newbrain offers greater memory expansion (to 512k), higher resolution graphics with an 80-column display option (for word processing), and interfaces which would allow disks and CP/M to be used. The Spectrum offers colour and sound, and the likelihood of cheaper disks, but seems to have limited expansion potential. How would you compare these for my application? Also, how does the Newbrain ANSI Basic compare with the Sinclair Basic?
A Wetter, London N1

As with so many questions it is, as you imply, very much a matter of selecting the right machine for your particular application, rather than one being 'better' than another in some general way. In your case the Newbrain seems to me to have a number of attractions. Firstly, it is generally about twice as fast as the ZX Spectrum in most benchmarks. Assuming that your medical work calls for searching databases of some type, this could be quite significant.

Secondly, the Newbrain has what is essentially a standard typewriter keyboard. If you, or anyone entering data on your behalf, can touch-type, this is a very great advantage over the Spectrum and its multi-function keys, with only limited movement. If you are a novice programmer these multi-function keys can be a great help, but with more experience they can become rather frustrating (which is only to say that the Spectrum is just right for its intended market!).

Again, if you want to use commonly available professional software, the ability of the Newbrain to support standard size disk drives, and to run the'industry standard' CP/M operating system is of great advantage.

On the other hand, the Spectrum offers a cheaper route to a system complete with disk drives (once the special micro-floppy drives become available) and a printer, and does provide colour graphics, if that is significant for your applications.

As regards the two versions of Basic, both strike me as being above average. The I/O handling on the Newbrain is a little complex, but very powerful, while the Sinclair Basic offers a much better method of handling sub-strings than does the more usual Microsoft Basic. Newbrain Basic is compiled rather than interpreted, and has some 200 error codes. This provides a better level of error spotting than with the usual interpreted versions.
P L McIlmoyle

Easy upgrade

I have a 16k ZX Spectrum with an issue two circuit board. This version has empty sockets for the memory expansion chips. Could you please advise me of the chips required to upgrade the memory to 48k?
Andrew G Mason, Colchester

For those who don't know the story so far, there have been two versions of the Spectrum printed circuit board. Version one requires an extra PCB to carry the 32k memory expansion chips, mounted 'piggy-back' style on the main board. When the board was redesigned, space was found for the expansion memory chips (and the necessary address decode logic chips) on the main board. This means that version two Spectrum owners can upgrade to 48k by just plugging in the extra chips, provided they don't mind invalidating the guarantee when they take the back off.

You can tell which you have, without opening it up, by examining the edge-connector at the back. If the gaps between the contact fingers are about the same width as the fingers, it is version one. If the gaps are much narrower than the contact fingers, it is version two.

The chips involved are:
Memory decode: IC23 – 74LS32, IC24 – 74LS00, IC25 – 74LS157, IC26 – 74LS157.
Expansion RAM; eight TMS4532-3 32k x 1 bit dynamic RAM.

Since 32k DRAMs are not easily available, it is much cheaper to buy your memory expansion as a chip set. There are several suppliers advertising at prices around £30.

Watford Electronics, 33 Cardiff Road, Watford, Herts, sell a Spectrum Upgrade Kit at £29.95 inc post & VAT, or you can buy it over the counter (phone Watford 37774 to check stock).
Len Warner

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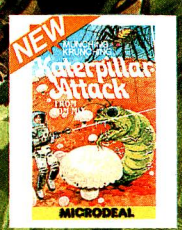
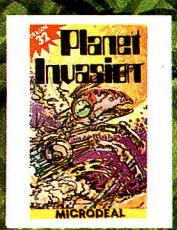
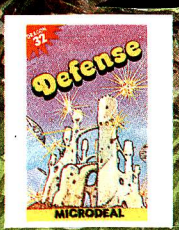
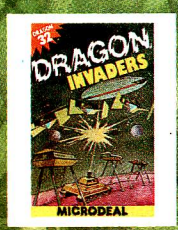
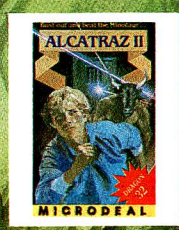
FROM TOM MIX

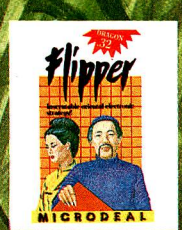


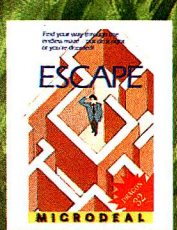


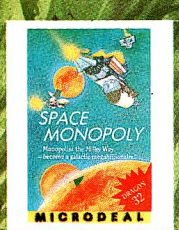


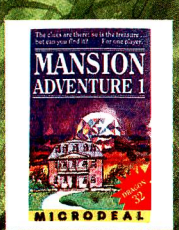


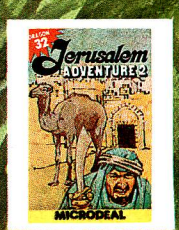


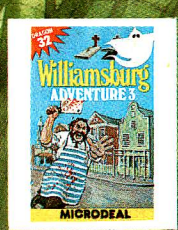


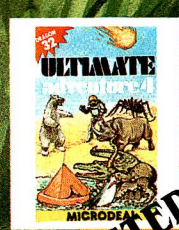












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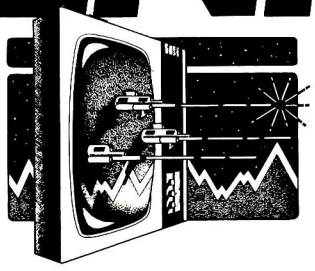
SCREENPLAY

Dick Olney tries out some Dragon 32 games.



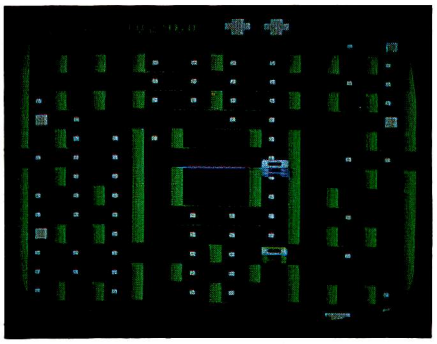
The Dragon 32 was launched last Autumn at the *PCW* Show and became one of the top sellers during the Christmas period. Despite setbacks in production it seems set to do well over the coming year, particularly when more software becomes available. The Dragon is based on the Motorola 6809 processor and offers 32k of RAM as standard for around £200 including VAT. The price includes Microsoft Extended Colour Basic, all of which makes the Dragon very similar to the Tandy Color Computer. Tandy has replied by dropping its prices, but the Dragon remains a better deal.

The Microsoft graphics are easy to use, but give average results with a rather subdued selection of colours. This means that, for arcade type games at least, the Dragon is not a particularly earth-shattering piece of hardware. Despite this I was pleased to find a good selection of high quality games readily available, though there's nothing very innovative.

Dragon itself has a small selection of cartridges on sale, all of which are cover versions of old favourites (but then what isn't these days?) and a range of cassettes, only a few of which are games. Microdeal of Bodmin has long been supplying software for the TRS-80 Color, and has thus very quickly established a huge range for the Dragon 32. Their selection is indeed impressive and includes games that I reviewed for the Tandy (such as the excellent Space Traders — now renamed Space Monopoly) as well as those below and many more.

All of the games I reviewed came on cassette, except the two Dragon Data ones, which are ROM cartridges. You will thus need a reliable cassette player as well as a pair of joysticks to play them.

Software supplied by Microdeal of Bodmin (0726 67676) and ASP Micro Systems of Islington (01-395 9095).



Game: Ghost Attack
Supplier: Dragon Data
Price; £24.95

Here is Dragon Data's Pac-Man rip-off, a version copyrighted way back in 1981 by Compterware according to the title screen. You are chased by Huey, Dewey and Louie around a fairly extensive maze containing no less than eight energy dots. This preponderance of dots is compensated for by the very brief period in which you can banish your persecutors.

The graphics on Ghost Attack are very clear but rather clumsy and not as colourful as they might be. Your character makes a sound like two glasses clinking together as it eats up the dots, and various other highly descriptive sound effects are included. There is nothing particularly special about Ghost Attack, but nevertheless it's well-produced and is probably the best Pac-Man you'll find for this machine. Mind you at that price it should be!!

Presentation:
Use of graphics:
Addictive quality:
Value for money:

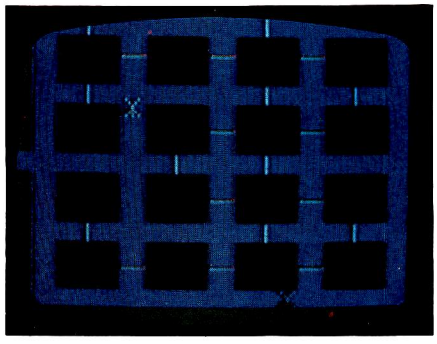
Game: Katerpillar Attack
Supplier: Microdeal
Price: £8

No prizes for guessing that this is the Dragon version of Centipede, the copyright of which is one of those held by Atari ('our game') UK, and which I reviewed in last month's Screenplay. Like Donkey King, Microdeal's other new game, this one is licensed from an American outfit called Tom Mix software.

In case you're not familiar with the game and missed last month's issue (God forbid!), it involves moving a small oval base around the bottom of the screen while firing upwards at long centipedes/caterpillars, each of whose segments has a life of its own. The playing field is scattered with mushrooms which take four shots to destroy. New mushrooms appear whenever you hit a caterpillar segment and in the wake of the creatures (fleas in the original but described as spiders in the introduction to Katerpillar) that occasionally hurtle down at you from the top of the screen.

Katerpillar is fast-moving with good graphics and sound. It certainly isn't nearly as exciting as the Atari cartridge version, but then it costs less than a third of the price. My only major criticism is that the base will only move very slightly in a vertical direction so that it's virtually impossible to escape the caterpillar segments when they reach the bottom. Incidentally, this also has the effect of making the game even more like Space Invaders, to which it is closely related. Still, this is an exciting game with plenty of mileage.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: Alcatraz II
Supplier: Microdeal
Price: £8

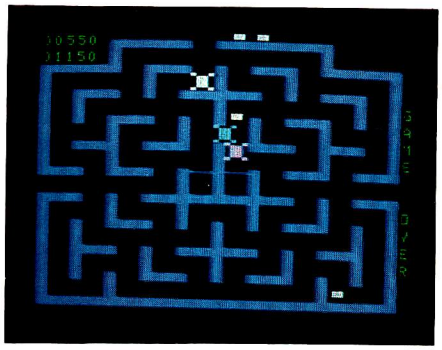
This is a very simple yet interesting game built around escaping from that infamous prison. Each frame involves manoeuvring your prisoner (shown in green) around a five-by-five grid of tunnels. Most of the tunnels are barred by a number of gates. These gates are impassable, but disappear when a guard — of which several are always in evidence — goes through. The guards are quite stupid, but will chase after you if given a direct view down the tunnel. As soon as you turn the corner, however, they will forget about you and go off in another direction.

The idea of the game is to persuade the guards to open enough gates to allow you a free run to the exit on the left hand side of the screen. Things are complicated further by wall lasers which periodically appear from the top or side to fill either all vertical or all horizontal tunnels with their deadly discharge. A a few seconds' audible warning is given before the lasers begin to appear, allowing you to position your prisoner in a safe place. Whenever the lasers fire, a

number of the gates are restored — thus having the effect of starting all over again.

The instructions to this game suggest that other evils, notably the Minotaur, inhabit some of the later wings; but due to total incompetence I failed to gain any proof of this. Although this game is highly addictive, perhaps because it's quite difficult to start with, the mechanics of it are rather trivial and, like most of the Dragon games, the graphics are fairly primitive.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



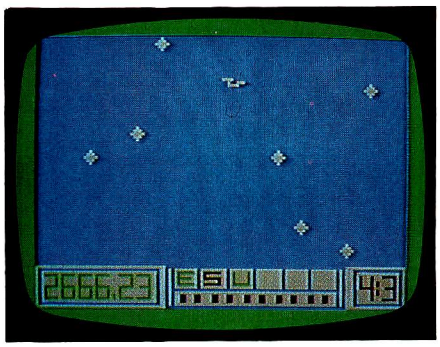
Game: Cave Hunter
Supplier: Dragon Data
Price: £19.95

If I said that this game involved moving a character around a maze, while being followed by several creatures that eat you if they catch you; unless you've recently consumed a power deposit, in which case you can eat them, what name would immediately spring into mind? But, you gasp, surely Dragon's Pac-Man rip off is called Ghost Attack and is reviewed elsewhere in this month's Screenplay? Well, you'd be right, except that in the short list of Dragon games cartridges available, along with Invaders and Asteroids, there's not just one, but *two* Pac-Man look-alikes.

Within the maze there are four energy packs (randomly placed) and four white squares of treasure. The idea is to leave your home at the top of the screen, get one treasure at a time, and return it to your base. After a few seconds a number of extremely vindictive cave monsters come out from their lair to abuse you. They travel quite fast and are very smart — though, as I've said, the tables are turned if you pass over one of the red power squares.

Clearly the details of this game are different to its famous forerunner, but nobody could deny that the principles are still there. If anything, I found Cave Hunter rather too difficult. It is essential to eat a power square before dropping off any treasure since otherwise the cave creatures will crowd around the entrance to your base, making it impossible to re-enter the game. Nevertheless the graphics are excellent — as are the joystick responses and general playing speed. Personally I'd never dream of paying twenty quid for Cave Hunter (mind you, I must admit that by now I'm sick to death of Pac-Man and its many pretenders) and, considering the high price of cartridges, I'd expect something more exciting — or at best more original. Still as arcade type games go on this machine this is one of the most challenging.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



Game: Dragon Trek
Supplier: Salamander Software
Price: £9.95

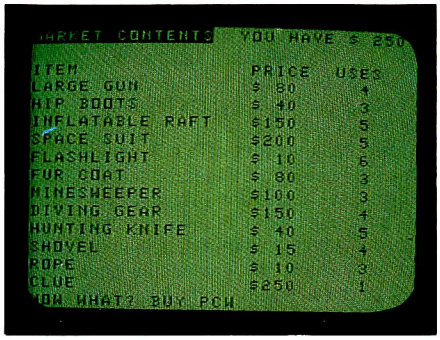
And so the battle against the Klingons goes on! Here is a polished version of that grand-daddy of computer games, with most of the standard features. At the beginning you have the choice of playing over a 6x6, 8x8 or 10x10 grid (representing the galaxy) with 10 different levels of difficulty. You spend most of the time looking at the tactical status display, which is a short-range scan of the quadrant you are occupying (showing stars, bases and Klingons) along with various information about your position and status.

The commands are initiated by a single key and include warp drive (w), long range scan (c), shields (s) and damage control (d). A red 'u' flashes at the bottom of the tactical status display when Lieutenant Uhuru has a message for you; this can be viewed by pressing the (u) key. Phasers are controlled by the first three number keys, giving three different ranges requiring proportionate amounts of energy.

Photon torpedoes can be launched — their path is controlled by the right hand joystick. This joystick is also used to move the ship on impulse engines when docking into retreat. Additional features include black holes and super-novae, though there are no planets to mine and neither Spock nor Scotty are given their usual prominence. The graphics are limited but colourful and decidedly enhance the game's attractions.

The idea, of course, is to destroy all the Klingons in the shortest possible time, a task which is not easy at the higher skill levels where long range tractor beams and secondary waves of enemy ships are common. If nothing else the game of 'Star Trek' has passed the test of time, and remains a must for any microcomputer games enthusiast. This version may not be as sophisticated as many that I've seen, but it's well presented and should provide hours of fun.

Presentation:
Use of graphics:
Value for money:



Game: Mansion Adventure/Jerusalem Adventure/Williamsburg Adventure/ Ultimate Adventure
Supplier: Microdeal
Price: £8 each

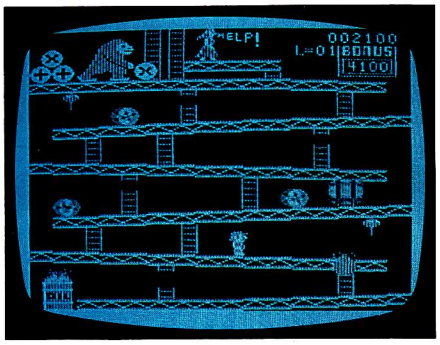
This set of classic adventures from Microdeal should prove extremely popular with Dragon users. The format is fairly standard, and the tasks interesting but not over-taxing. In the first three you are set a task and wander off into the scenarios suggested by the titles. Though there are not as many locations as one might expect, the action is imaginative, with plenty of humorous red herrings.

The Ultimate Adventure starts in a marketplace, in which many items are available, each of which has a number of uses. You start out with $250, with the idea of the game being to increase this to $1000. All the merchandise has a different price but the last item on the list, a clue, will always cost you all your money so it's best to buy this last while your funds are low. The locations represent a wide variety of different environments including the Arctic, a desert and an ocean, and space. You begin with 250 strength points which decrease throughout your various encounters. To regain your strength you must spend time in the infirmary, but you'll have to find it first!

If you've got a Dragon and haven't yet tried an adventure game on it, these are as good as any, though they might prove rather simple for the really experienced adventurers. The first three are in an entirely traditional format, whilst the fourth offers something slightly different. If you are unfamiliar with adventure games you should note that, although they may take some considerable time to complete, once solved they are of no further interest and this should be kept in mind when assessing their value for money.

Presentation:
Complexity:
Value for money:

SCREENPLAY



Game: Donkey King
Supplier: Microdeal
Price: £8

This is Microdeal's latest release and is, of course, a version of the curiously named arcade game 'Donkey Kong'. The scenario is an old warehouse where a huge gorilla (clearly a relative of King Kong) is holding a young woman prisoner. Each frame (there are four) has a different configuration of horizontal girders linked by ladders, with the belligerent ape and his terrified captive at the top. To start with, your job is simply to climb from the bottom of the screen to the top and rescue the girl, though this is complicated by the endless supply of barrels which are consistently hurled down at you by the gorilla.

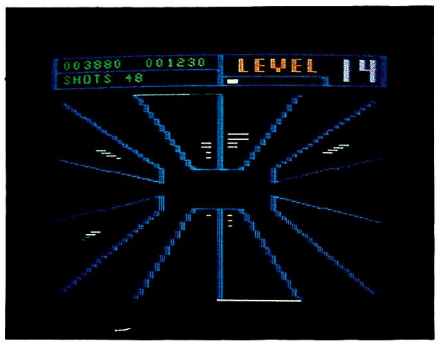
You use the joystick to control a little character who leaps whenever you press the fire button. Apart from jumping over the barrels your only other defence is to smash them with a mallet, of which two are available at different levels of the screen. These mallets will destroy the fireballs which wander about the place, but possession of them is only temporary, and you cannot climb any ladders while holding one.

If you manage to reach the top on the first frame the scene changes. Now you must run over eight 'plugs' symmetrically positioned in the structure, whereupon these will disappear — eventually causing the girders to collapse and the gorilla to fall to the floor. This time there are no barrels but plenty of fireballs. As the game goes on all sorts of hazards appear including conveyor belts, furnaces, and lifts, each demanding a different strategy.

I have always felt this game was one of the most interesting and challenging around, and this version is one of the best you'll find on a micro. It offers two different playing speeds for one or two players with the option of a 'practice' game in which you get 12 men instead of three. Full instructions are available at the beginning.

Three copies of Donkey King are included on the tape, giving three different colour schemes. The third is in the highest resolution graphics and is thus less colourful than the other two, but was nevertheless definitely my favourite with crisp detailed graphics almost up to the standard of its arcade peer. If I had to recommend one arcade type game to a Dragon owner this is certainly the one I'd choose; it's well worth the money.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



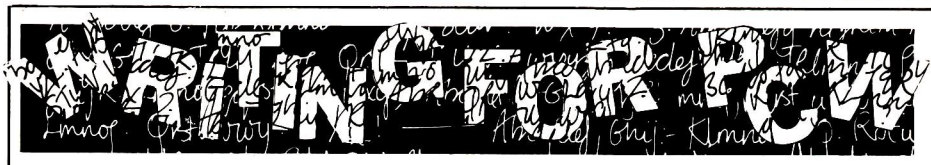
Game: Storm
Supplier: Microdeal
Price: £8

This is the first micro version I've seen of the spectacular arcade game Tempest, reviewed last summer in the Arcade Ace slot. As you'll appreciate, the graphics and noises don't even come close to the original but, nevertheless, Storm is well thought out and has a nice feel to it. Using the right joystick (it's a one-player game) you move a white bar around the edge of a receding tube or tunnel, represented as a series of coloured lines forming a segmented pattern. Pressing the fire button discharges a burst of fire along the segment whose end you are covering.

Various coloured bars float outwards from the centre of the screen along the segments, and it is these which you must destroy. They will zap your bar if they make contact and, in addition, the orange ones (called 'Millibars') will chase you around the edge of the tube if they are allowed to reach it. Mostly the bars will approach in rotation but every so often a massive attack is launched in a colourful melee.

Storm, though *much* easier to play than the arcade Tempest, is somehow hypnotic to play. The graphics are simple but professional, and the subdued sound effects are among the most bearable I've heard on the Dragon. There are no instructions, so it may take a little while to work out what's going on, but if you're looking for an arcade game this should prove good value for money.

Presentation:
Use of graphics:
Addictive quality:
Value for money:



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If your article is already written, send it in — taking care to ensure that your name and address, together with a daytime phone number if possible, appears on both the covering letter and the manuscript. Manuscripts should, preferably, be typed or printed out (dot matrix output is quite acceptable) but *must* be double line-spaced with ample margins top and bottom and on each side. Make sure you keep a copy of *everything* you send us.

We can now accept articles on a limited number of disk formats: standard IBM 3740 single-sided, single-density 8in, and the following 5¼ in formats: Superbrain SSDD 35-track; RML 380Z SSSD; Sharp MZ-80K/A DSSD, Cromemco SSSD, Nascom DSSD, Rair/ICL DSDD, SD Sales SSSD, Triton 35 track SSDD and ACT Sirius 1 (CP/M-86 or MS-DOS) single-sided. By prior arrangement we can accept stuff over the phone by modem using BSTAM at 300 baud but as we can only do this during office hours (10am to 6pm) it's not exactly a cheap way of getting your article to us! In the near future we hope to be able to accept material by The Source and Rewtel. Please note that if you want to send your article in this way, it should be as an ASCII file rather than as a 'work file' for any one type of word processor — ie, use your word processor to print the text to disk instead of to paper.

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Once you've sent off your article or proposal, please don't hassle us for a decision. We receive far more submissions than we can ever use and it takes us a while to sort through them, acknowledge receipt and give an opinion one way or the other. Please be sure to tell us if you've sent the article to another magazine — it would be very awkward indeed if the same article appeared simultaneously in two publications! Frankly, we're more likely to accept something which has been offered exclusively to us.

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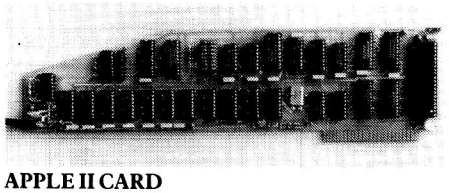
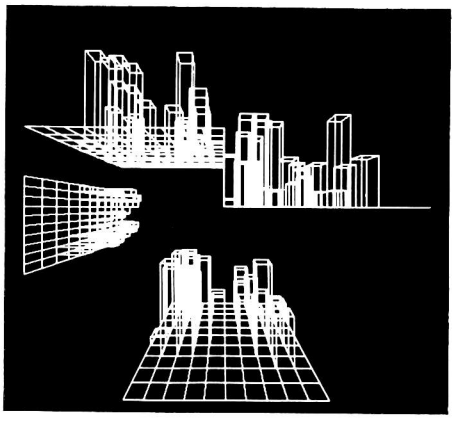


APPLE II CARD



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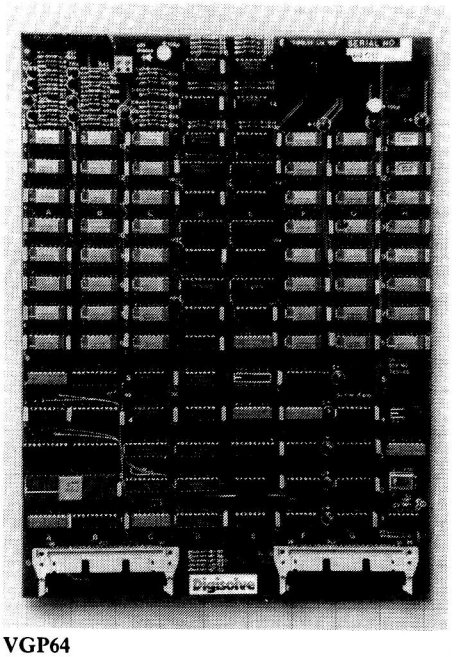

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READ ALL ABOUT IT

Documentation can make or break a product — particularly when that product is aimed at the naive user. Jane Bird investigates the varying standards, and calls for higher quality from manufacturers.

Computer manufacturers may be missing out on vast market opportunities by failing to provide good documentation for their products. As the marketplace gets bigger there are more and more users coming to computers for the first time. For them the standard of documentation can be the difference between mastering the new technology and being defeated by it. It is of vital importance. And if they can catch a glimpse of a product's documentation before they buy it, then this may be the deciding factor on whether or not they make the investment.

In the past, documentation of computer products has been notoriously bad. All too often the task has fallen to the very experts who designed the software or hardware. These people are the least qualified to explain a system to a non-expert. They can't imagine what it feels like not to understand computers, or to be frightened of them, and they certainly can't explain them to the layman.

But the signs are that this is beginning to change. Good documentation is another weapon that a company can muster in the ever fiercer field of international competition.

It is rather sad, perhaps, that the company which seems to have done most, or had most influence in setting new documentation standards is the monumental institution IBM. How much more satisfying if it had been the brainchild of one of the dynamic small young companies! Nevertheless, IBM it is and others are following suit.

According to Joe Maiorano, former senior accounts representative at Micro-Pro, the standards that IBM selected have stuck.

'IBM has pioneered a standard for documentation along with all the other hoopla over the IBM Personal Computer. Microsoft and Digital Research have already followed IBM's format. Micro-Pro has come out with newly formatted versions of the Wordstar manual in the US although I can't say when these will be available in the UK,' Maiorano told *PCW*. But the Wordstar manual will still be written in American English as Micro-Pro is concentrating its language effort on French, German, Swedish and Italian.

Maiorano agreed that documentation can be a big selling point. 'If a product is new it is difficult to market without really fine documentation. I looked at a couple of word-processing packages lately which, although they tended to be very powerful, had such haphazard documentation that a customer wouldn't look twice at the product.

'On the other hand, a product that is established with a reputation is different. In the case of a product like Wordstar people come in asking for it and it doesn't matter what the documentation looks like – they know the product is an industry standard. So terrified are people about incompatibility and getting lumbered with some weird, idiosyncratic package, that they'll accept bad documentation just to keep in the mainstream.

'But software piracy bears a lot of responsibility for poor manuals. One problem with documentation can arise when people obtain illegitimate copies of Wordstar,' said Maiorano. 'I have seen some people receive a disk with a really poor photocopy of the manual, and neither the training package nor the quick reference card.' This happens when dealers and others sell illegal copies of software and have to drum up the documentation by underhand means.

But I mentioned that there are indications that manufacturers are becoming more aware of the need for accurate and intelligible manuals for non-experts.

One new company set up to produce documentation for naive users is Baddeley Associates, based near Cambridge.

When beginning a manual they take as their starting point the role of the naive end-user. 'This role can be very difficult for the companies to enact for themselves. Their technical writers and programmers are too close to the material to know how it would appear to a newcomer,' says Julie Baddeley.

She believes that we have got away with bad documentation in the past because packages haven't been sold in large enough numbers. Users have had fewer packages to get to grips with, and have heroically risen to the challenge. But now packages are sold by thousands rather than hundreds.

At exhibitions and in shops people will leaf through manuals and it may be their main way of acquiring information and impressions about a product.

Baddeley points out that this can contribute significantly to sales at exhibitions.

'The situation at the moment is that if you go to a show and try to look at a manual on a company's stand either they haven't got it or it is hidden in a desk somewhere. Companies may be missing out on a potentially massive marketing tool.'

But it is not as simple as just imagining the user to be a complete novice. The manual has to be equally useful to experienced and sophisticated users who simply need a reference tool.

One of the major challenges in producing a manual is that it has to cope equally with the total newcomer and with the accustomed user who needs a reference tool.

In the introduction Baddeley Associates try to explain 'what a product is for, not just how to use it. We try to explain why you do what you do rather than just telling the user to do it.'

The manual must serve as a convenient reference volume for the experienced and sophisticated user. Having helped the first-time user to learn the system it must not then drive him to frustration and distraction with regular use.

One way of handling this is to begin with a so-called tutorial section, 'although tutorial is an ambiguous word which may or may not include a worked example,' said Julie.

At the user end business systems are not usually purchased by the people who are actually going to use them. 'Often the person who has manually to use the system will not be an enthusiast and you have to bear in mind their level of computer knowledge. Nothing in the manual may be at a higher level than that. Writing a manual for a Forth enthusiast is very different.'

When you are considering the total newcomer you may have a very limited customer. Baddeley Associates is writing a manual for a word-processing package to be used by five- to seven-year-olds. 'The author of the documentation has to be able to imagine the literacy level because you can't use a complicated language to explain a system to a child. Nor, in its turn, can you expect the child to use complex language to address the system.'

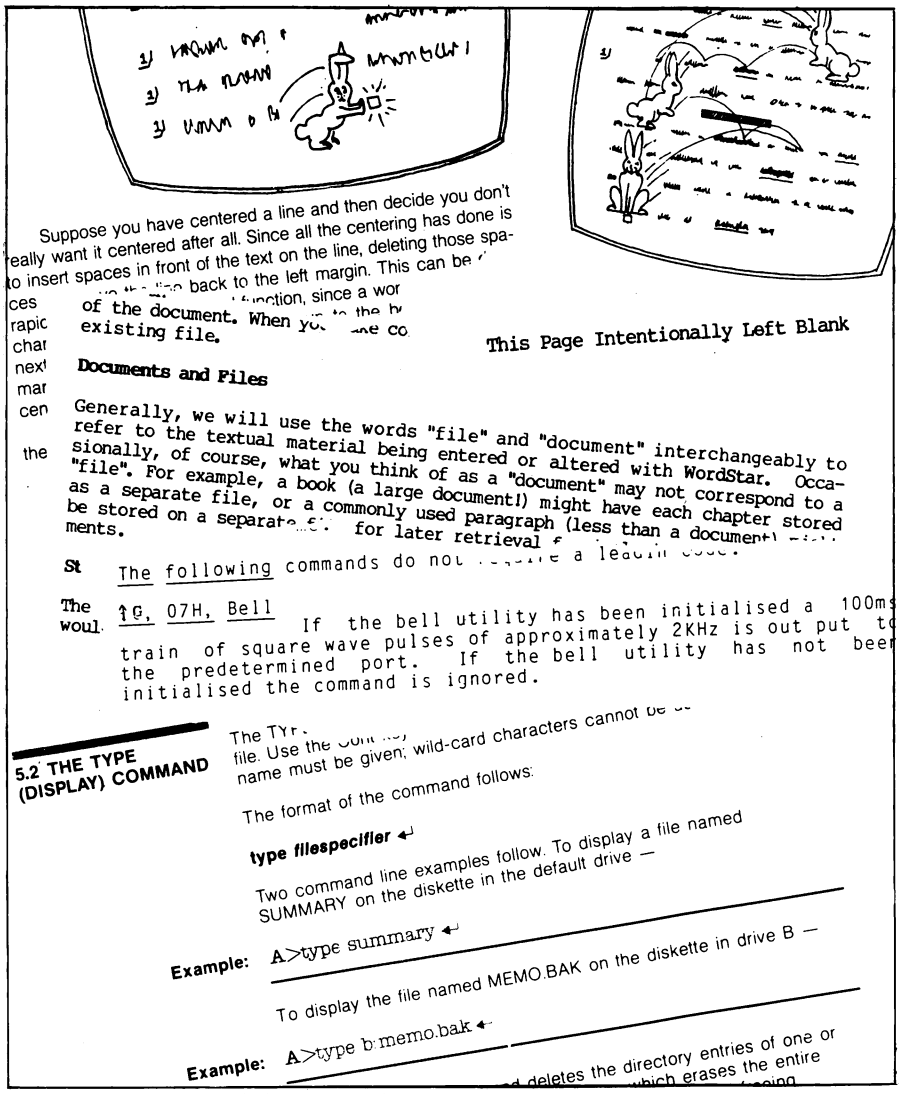
One popular tutorial method in manuals is the worked example. But Julie has strong thoughts on these; she doesn't like them.

'They can be terribly frustrating. After all, when I sit down with my brand new system I want to do something that I want to do, rather than fiddle about with some ghastly convoluted and totally unbelievable piece of text that has to be edited and re-edited.'

Probably the single most essential ingredient of a good manual is a good index. But there is more to creating an index than just picking out the key words. It can be very difficult because you can't only index by words that appear in the text. You have to think what a person would actually look for.

Take the Sirius CP/M manual, for example. If I don't know CP/M and I want to delete a file I naturally enough look up 'delete' in the index. But do I find anything? No. I have to look up ERA for ERASE. Then suppose I want to COPY, PRINT or DISPLAY a file. Nothing appears in the index under any of these key words. The command I actually need is PIP, but how on earth the first-time user knows this is unfathomable! And the Sirius is supposed to be an exceptionally user-friendly machine.

'The right sort of manual is the one that



The good, the bad and the patronising...

the managing director might read on the train going home from work,' said Julie.

'You have to try and condense the material while keeping it comprehensible. If it still has to be 200 pages long then we make sure it is chopped down into clear, distinct sections. And take Wordstar.'

Maiorano agreed that the size of Wordstar is too big. 'It is totally imposing for first-time use – that is why the training guide was developed. Every copy of Wordstar is supplied with a self-teach guide composed of three levels: beginners, intermediate and advanced. It is set up for the stenographer – ring-bound at the top with pages which flip over as you progress.' Using this tool, Maiorano claimed that in a day you can learn enough of Wordstar to create and print documents making use of special formats such as 'underline' and 'bold'. The training guide gives you enough to belong to the 80:20 club (the 80% of the people who use 20% of Wordstar).

All the Micro-Pro manuals have undergone revision. InfoStar – the database management package – has been redocumented according to the IBM format. This is a smaller ring binder in a box about 9 inches by 6 inches and decked out in the corporate colours. 'It is written in a much more friendly style with more end-user-oriented pictures including cartoons,' said Maiorano.

A good manual also needs a system of strong visual aids to prompt the user and remind him where he is and what he is doing in the package. Baddeley Associates has one specific technique which involves the use of a small picture of the screen in the left-hand margin to remind people which menu they're dealing with.

You would think, wouldn't you, that having English as a first language would give UK manufacturers a lead over their Japanese rivals? This is by no means always the case, however, although people sometimes make a half-serious joke that you can see a manual is a direct translation from the Japanese. US companies occasionally get round to producing English-spelt versions for the UK but on the whole the US has a better record on good documentation.

'You tend to get customers saying they want things done to the industry standard, but what is the industry standard? It is very subjective. Some people say, produce to the standard of IBM, and others say, whatever you do, don't produce something like IBM,' said Julie.

'All too often the industry standard is a photocopied dot-matrix sheaf.'

Baddeley Associates is a small company consisting of Julie, her husband, another writer, technical expert Chris Jordan and a secretary. They are concentrating on business systems' documentation at the moment.

One interesting development on the documentation front is the super-user-friendly Lisa system from Apple and its competitor VisiOn. These systems use the 'mouse' which allows the user to create and execute commands without using the keyboard. In a sense they represent an attempt to by-pass completely the manual stage. They allow the user to get his hands straight onto the machine and start doing meaningful tasks. Nothing is more frustrating than being ordered on no account to start using the machine until you have read, understood and inwardly digested an entire 500-page manual.

But Lisa and VisiOn, are incredibly expensive to build and Apple and VisiCorp proudly boast of the hundreds of man-years' worth of effort that have contributed to the product. The manual has an intermediate role to play for a long time yet.

Baddeley noted that producing manuals is an occupation 'full of hassles'. As soon as you start documenting something you highlight all the faults – then you find the programmers want to take the faults out so you have constantly to change what you write. It is basically a job processing lots of information.

The writing of the manual can be the turning point in a product's life, for there is nothing like trying to explain a system to a new user for showing up the system's faults – like a nasty symptom that just won't be subdued. As for the cost of providing good documentation – it rather depends how you look at it. It can eliminate the need to produce special scripts for salesmen's demonstrations, and it can also provide an invaluable support in selling the product.

Baddeley believes that writing a manual is not a prescriptive task. It is not something for which you can set a formula that will apply every time. There is currently a program which generates a manual according to standard bits of information that you give it about your system. Clearly this cannot incorporate an imaginative understanding of what the new user might find difficult.

'Another thing I can't stand is the manual which adopts the effusively friendly approach. I don't like the "Hi folks, this is your marvellous manual" style. This is all right first time but gets exceedingly irritating remarkably fast,' said Julie.

It can be very difficult to actually go out and examine what is available on the market because manuals are so tied up with software copyright. Baddeley suggested that the government might set up a centre where prospective buyers could go and browse through manuals and choose the product to their liking.

The only manuals she knew of that she had specifically heard were good were Caxton, and a new manual for the Osborne.

So all you micro-manufacturers out there would do well to look to your documentation. There are lots of similar products these days, with little to choose between them and chances are that a good manual will be a clincher.

END

SPEEDING UP THE NASCOM

Quentin King explains the technique of communications between Nascom Basic and USR subroutines.

Basic, like all high level languages, is often unsuitable for specialised, high speed subroutines. For this reason, it provides access to machine code via the USR and CALL instructions. These subroutines often require additional information such as variables, strings or direct data. However, most 8k ROM/tape Basics allow only one variable to be supplied. Additional information must be POKEd into memory before calling the routine. Nascom Basic is no exception. However, by calling routines within the Basic ROM, it is possible to retrieve as many values or variables as required.

The demonstration program was written using ZEAP 2.1 and NAS-SYS monitor program. It will retrieve four types of data following a USR(X) instruction. These are:

1) Direct numeric values —
   eg, A=USR(X),1,20,42
2) Direct string data —
   eg, A=USR(X),"Hello","Byte"
3) Numeric variables —
   eg, A=USR(X),B,C,BC
4) String variables —
   eg, A=USR(X),A$,B$,CD$

Items of data can be in any order, being separated by commas. All spaces (other than those within quotes) will be ignored. For the purposes of demonstration, all the program does is print the data. For example:

```
10 A$="HI":B=10:DOKE 4100,
   3200:REM USR ROUTINE
   LOCATION
20 K=USR(255), A$," THERE! ",
B,20
Ok
RUN
00FF HI THERE! 000A 0014 Ok
```

Obviously, the print subroutines could be changed in order to store data in memory for use later.

Basic keeps track of where in a program it is by means of a program pointer. Before jumping to a USR routine, it PUSHes this pointer onto the stack. This means that by POPing the return address of the stack you can then retrieve the pointer. Having interpreted the following data, the program replaces the program pointer and return address on the stack and then returns to the Basic program.

I used this program to pass variables to graphics software; to draw a line used to be. . .

```
DOKE 3208, X1:DOKE 3210,
   Y1:DOKE 3212,X2:DOKE 3214,
   Y2:A=USR(5)
```

. . . and with the new software:

```
A=USR(5),X1,Y1,X2,Y2
```

Using string variables, named taped files can be easily implemented from within a Basic program. Also, a renumber routine can receive values for the first line number and subsequent increment. These are just some of the applications of this routine; I am sure there are many others.

```
ZEAP Z80 Assembler - Source Listing

                0010 ; ************************************
                0020 ; ***   USR Demonstration program.   ***
                0030 ; *** Written for the NASCOM II with ***
                0040 ; ***   standard BASIC and NAS-SYS   ***
                0050 ; ***           monitor.            ***
                0060 ; *** ------------------------------ ***
                0070 ; ***       By Quentin King         ***
                0080 ; ************************************

0C80            0100        ORG  £0C80

                0120 ; Retrieve USR argument in DE

0C80 CD8BE9     0140        CALL £E98B

                0160 ; Call print routine to display DE, this
                0170 ; could be replaced with a routine to
                0180 ; store DE in a memory location.

0C83 CDEC0C     0200        CALL PRINT

                0220 ; Get the BASIC program pointer by first
                0230 ; POPing and storing the return address
                0240 ; in IX

0C86 DDE1       0260        POP  IX
0C88 E1         0270        POP  HL

                0290 ; HL now holds the address of the
                0300 ; character following the USR(X)
                0310 ; First, call the subroutine to move
                0320 ; HL over any spaces within the line...

0C89 CDE50C     0340 START  CALL SPACE

                0360 ; ...then test if the first non-space
                0370 ; character is a comma and if it isn't,
                0380 ; jump out of the routine.

0C8C 7E         0400        LD   A,(HL)
0C8D FE2C       0410        CP   ","
0C8F 2060       0420        JR   NZ,END

                0440 ; It is a comma, so valid data must
                0450 ; follow. First, move HL over any
                0460 ; following spaces, then test if the next
                0470 ; character is a " (open quote). If
                0480 ; it is, jump to QUOTES routine to
                0490 ; print string (terminated by another "
                0500 ; or by a NULL)

0C91 23         0520        INC  HL
```

```
0C92 CDE50C     0530        CALL SPACE
0C95 FE22       0540        CP   ""
0C97 283C       0550        JR   Z,QUOTES

                0570 ; It isn't a quote so it must be :
                0580 ;
                0590 ;   1) Direct data.       e.g. USR(X),1,2
                0600 ;   2) Numeric variable.  e.g. USR(X),A,B
                0610 ;   3) String variable.   e.g. USR(X),A$,B
                0620 ;
                0630 ; Therefore, test to see if character
                0640 ; is numeric (0-9), if so, Carry flag
                0650 ; is set and jump is made to 'NUMBER'
                0660 ; routine.

0C99 CD37E8     0680        CALL £E837
0C9C 382F       0690        JR   C,NUMBER

                0710 ; Not a number so must be a variable.
                0720 ; First call routine to find
                0730 ; variables (returns with DE pointing
                0740 ; to it)...

0C9E CD2DEF     0760        CALL £EF2D

                0780 ; ...then test to see if it is string
                0790 ; or numeric: Location £10AD is set to
                0800 ;             01 if string and 00 if
                0810 ;             number.
                0820 ; NB. This above routine moves HL past
                0830 ; the variable and leaves it pointing
                0840 ; to the next character. Therefore
                0850 ; HL is now saved onto the stack.

0CA1 E5         0870        PUSH HL
0CA2 3AAD10     0880        LD   A,(£10AD)
0CA5 B7         0890        OR   A
0CA6 200D       0900        JR   NZ,STRING

                0920 ; Variable is numeric. DE is pointing to
                0930 ; it. First load HL with DE, then call
                0940 ; routine to move variable pointed to
                0950 ; by HL, into location £10E4.

0CA8 EB         0970        EX   DE,HL
0CA9 CD51F8     0980        CALL £F851

                1000 ; Now call routine to convert normalised
                1010 ; floating point number at £10E4 into
                1020 ; 16 bit hex in DE

0CAC CD8BE9     1040        CALL £E98B
```

GOTO page 173

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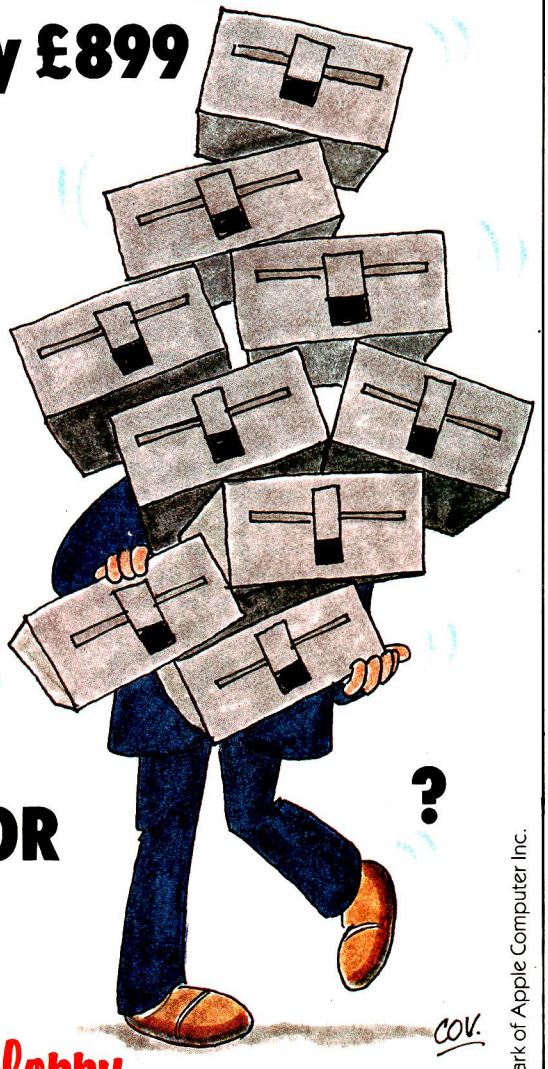

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BENCHTEST

THE ORIC 1

Another contender for the home market, tested by Steve Mann.

The appearance of the Oric-1 has demonstrated once again the almost comical inability of British micro manufacturers to launch a new machine properly. Funded by British Car Auctions and utilising the considerable experience of Tangerine Computers, the Oric is aimed at the fastest-growing sector of the micro market — the sub-£200 home computer.

The delivery difficulties that dogged both the BBC Computer and the Sinclair Spectrum should have alerted Oric to the pitfalls ahead, but the new company observed their rivals' mistakes, then promptly went out and repeated them. Adverts inviting customers to send off their cheques began appearing in October, and prospective buyers of the 48k machine had the additional carrot of a free Forth cassette dangled in front of their noses. 30,000 orders were received in the first two months and Oric was confident that large numbers would be delivered in time for Christmas. But delivery of ROM chips was delayed, and it became apparent that Oric's deadlines were hopelessly optimistic.

PCW received a pre-production model for a review on 23 December. It didn't work. It was impossible to get any sort of display, there was no editor in the software, the demonstration tape demonstrated only that it wouldn't load, and the 'manual' was a hastily assembled 32-page booklet that couldn't even get the syntax for loading programs right and gave no hint of the micro's capabilities.

After Christmas a second machine arrived. This one had an editor — but the display was still faulty and the demo tape was still unloadable. Feeling that even attempting to review this would be unfair to Oric — even though they presumably wanted an appraisal; after all, it had been sent out as a review machine — we accordingly exchanged it for a third model, which again arrived minus any proper documentation, although the worst mistakes in the booklet had been corrected.

The stupid thing about all this is that the worst sufferer of the debacle has been Oric itself. I've always felt that it is pointless to send a micro out of the factory without a proper manual. It would have been far better if Oric had held back on the hardware (and the advertising) until the full manual was ready — after all, if you manufacture a product and are keen to get publicity from reviewers, surely it makes sense to ensure that those reviewers get all the information necessary to write about it? As it happened, the full manual did not arrive until some weeks after review machines had been sent out.

As a result of this short-sightedness, reviews have already appeared in some magazines that will have dissuaded a large number of prospective purchasers from buying. These reviews have contained wrong information and have failed to mention any of the Oric's strong points. This is no reflection on the journalists involved — there is no way they could have done a proper job with the material provided.

Anyway, back to the *PCW* review machine. This still contained numerous bugs and Oric's long-suffering PR firm replaced it yet again. By now, time was running out and it was evident that, bugs or no bugs, this was the model that would have to be reviewed. So, here goes. . .

First of all, let it be said that the Oric-1 represents extraordinarily good value for money. To produce a 16k colour and sound machine, with Centronics printer interface and RGB monitor socket fitted as standard, at a price of under £100 is quite an achievement. I suspect that most people will probably go for the 48k version which, at just under £170, is slightly cheaper than the 48k Spectrum. It is inevitable that the Spectrum will be Oric's main rival, and the Sinclair machine has a good headstart, having just clocked up 200,000 sales. Accordingly, throughout this review, comparisons will be made with the Spectrum.

Hardware

The Oric-1 is housed in a reassuringly robust wedge-shaped plastic casing, finished in matt black and grey and adorned with a couple of thin blue lines. Oric makes much of the 'drivability' of its baby, so I can only assume that these lines are the equivalent of the 'go-faster' stripes lovingly applied by keen Cortina owners. Measuring 280x175x52mm, the Oric weighs in at 1.1kg.

The keyboard has 57 keys, described as possessing 'tactile feedback', which are a sort of halfway house between a full keyboard and the Spectrum 'dead flesh' keys. The keys are set at the correct angle and are the right distance apart for accurate typing. Keys have a positive feel and bleep when contact is made; Return and control keys giving a deeper tone than the alphanumeric ones. All keys have auto-repeat. The keyboard is considerably less cluttered than the Spectrum's, with a maximum of two functions per key. The cursor control keys are sensibly arranged on either side of the space bar.

Opening up the case reveals a very neat and uncluttered interior. It is clear that a lot of thought has gone into the layout; components are neatly arrayed in groups and there are no last-minute additions or alterations as there are on the Lynx or Spectrum. There are eight 64 kbit RAM chips, 16 kbytes of which are overlaid by ROM. External control signals will allow the use of the full 64k RAM.

Next to the 6502A microprocessor in the centre of the board is the loudspeaker, which is driven by a General Instruments 8912 sound chip. To the rear are the connections to the outside world — reading from left to right these are: TV output, RGB monitor (5-pin DIN), cassette interface (7-pin DIN), Centronics printer interface, which can double as 16 general-purpose I/O lines, and the main expansion port; this allows connection of the modem and microdrives and gives control lines for RAM and ROM to be externally expanded. The disk pack and microdrives will use these lines to give 64k internal RAM on the 48k model. In our review machines ROM chips were not fitted; instead there were two EPROMs. All references to 'ROM' in this review should take this into account.

Underneath the machine is a reset button which provides a 'warm start' facility, enabling the Oric to be reset without losing the contents of memory.

Software

The Oric uses an extended version of Microsoft Basic. Unlike the Sinclair dialect, this version does not use 'tokenised' keywords — all these have to be entered in full. A welcome consequence of this is that the keyboard presents a much less cluttered appearance; wheres on the Spectrum some keys have as many as six functions, on the Oric each has a maximum of two.

On power-up, the display is in TEXT mode with caps lock on. This is important as all keywords and variables must be entered in upper case — any attempt to use lower case is met with '?SYNTAX ERROR'. Variable names can be of any length, but only the first two characters are recognised. Great care must be taken when choosing variable names — the Oric is very

photography by Peter Mackertich.

fussy about what it will accept. Despite the fact that only the first two characters are significant, reserved words anywhere in the variable title will stop execution of the program. Unfortunately there are a lot of reserved words, and the characters that make them up occur in many descriptive names — you can't, for example, have a variable called 'SCORE' as that contains the Boolean operator OR; TO crops up in 'TOTAL'; and it is all too easy to overlook combinations including ON, AND, IF, etc. The manual is strangely reticent on this subject — it warns against the use of 'PIG' or 'PIPES' as they both contain PI, but then gives an example using 'JONI' which contains the reserved word ON and thus doesn't work. I can't help thinking that this could have been avoided — after all, the Oric is perfectly capable of differentiating between EXP (exponential) and EXPLODE (a built-in sound command) — and it will no doubt prove extremely irritating at times.

Variables can be suffixed with '%' to indicate an integer in the range -32768 to 32767; this is supposed to speed execution time, although on running the Benchmarks I found it made little difference — in some cases using the integer suffix even appeared to make it slower!

Strings may be up to 255 characters in length, and are concatenated (joined together) with +. Strings may be compared by using =, <, >, <=, >=, and <>, and manipulated with ASC (returns ASCII code of the first character), MID$, LEFT$, RIGHT$, VAL and LEN. The function STR$ will convert a numeric expression into a string but a bug in the review machine's ROM prevented this working properly. For example,

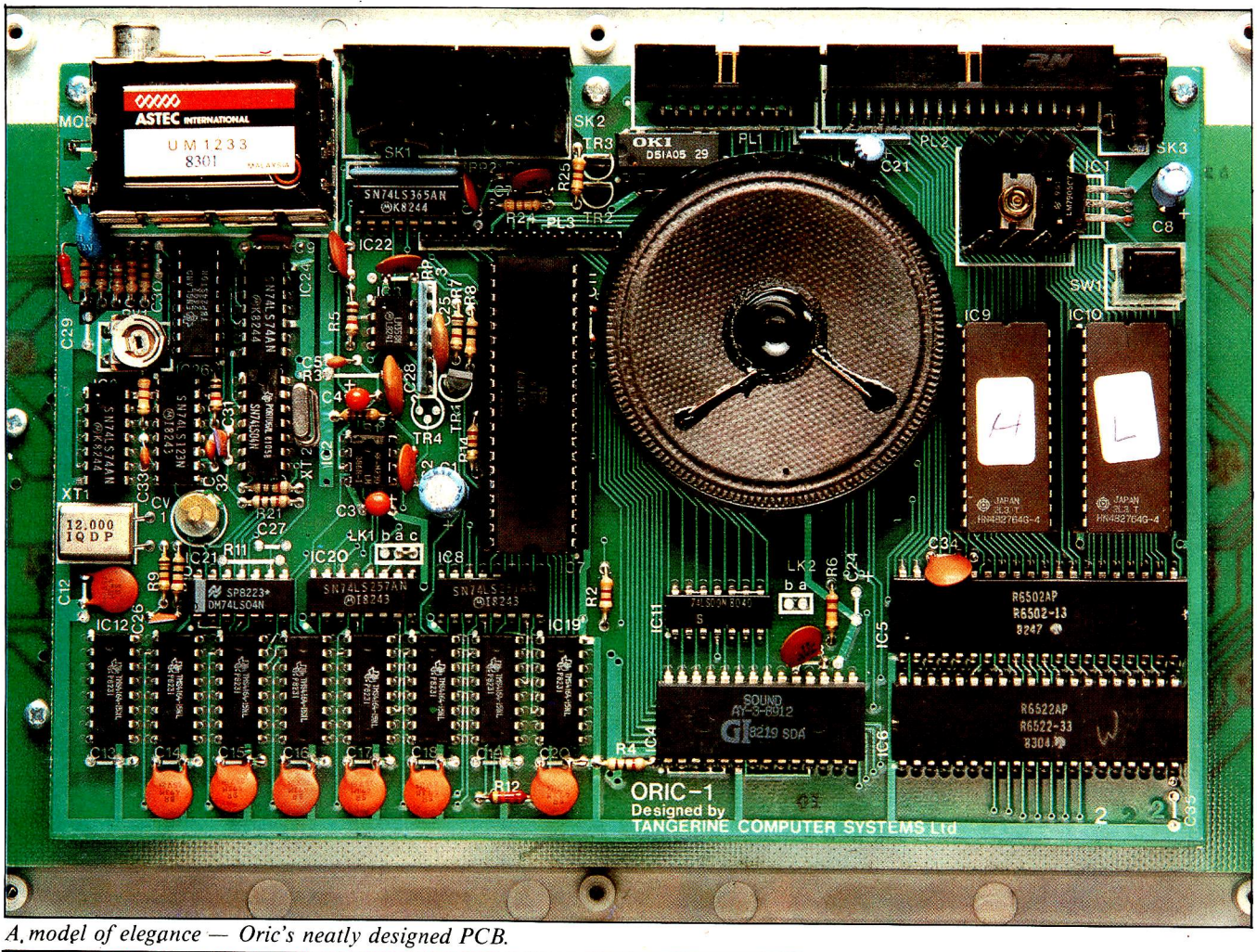
```
10 A = 1234
20 A$ = STR$(A)
30 PRINT VAL (A$)
40 PRINT LEN (A$)
```

should produce 1234 for VAL and 4 for LEN. On our machine the results were 0 and 5 respectively. Somehow the Oric is inserting an invisible control character into A$. To get round the problem you need the somewhat convoluted program line

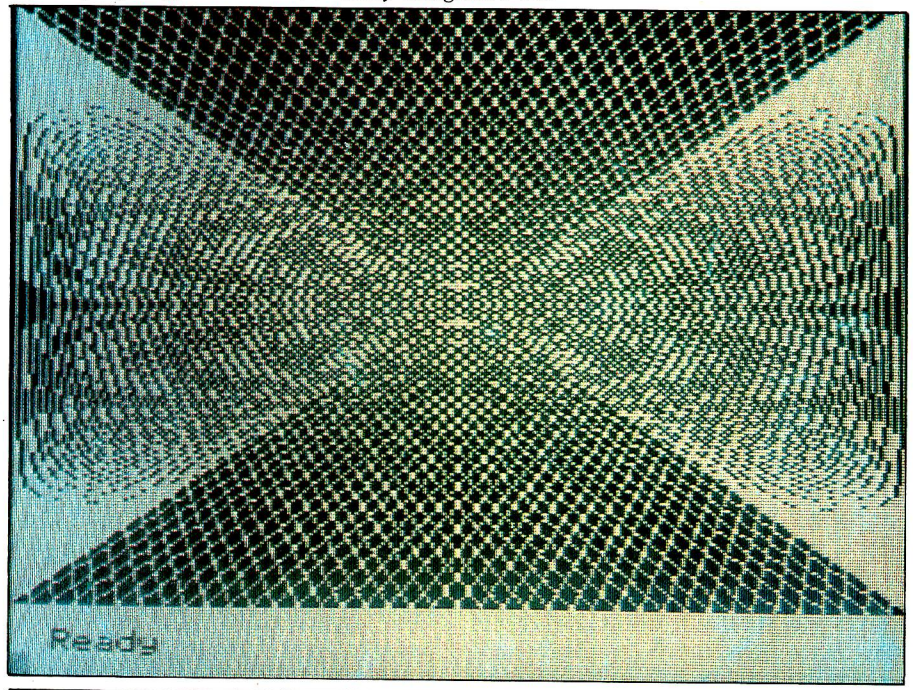
```
30 PRINT VAL (MID$(A$,2,LINE A$))
```

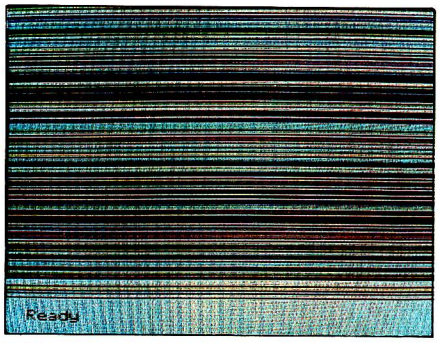
This strips off the unwanted first character and gives the correct result.

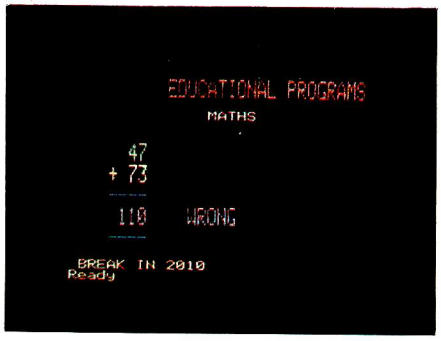
While on the subject of bugs, it should be noted that the TAB command does not function properly, either. The syntax for this is TAB(N) and on the review model values of 1-10 had no effect at all while other values had a seemingly haphazard result. The TAB bug is all the more unfor-

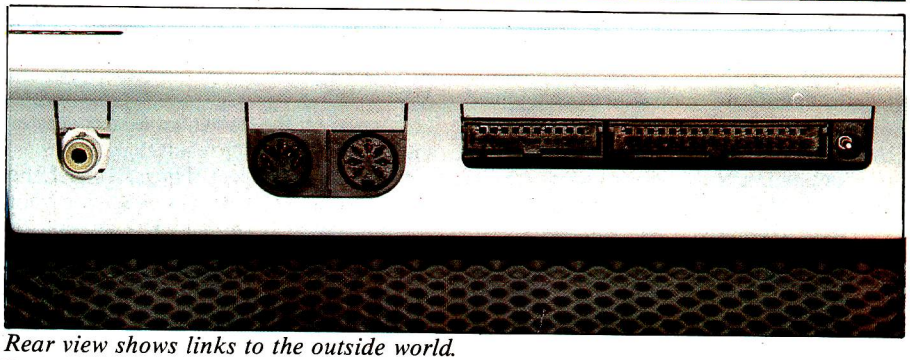


A, model of elegance — Oric's neatly designed PCB.

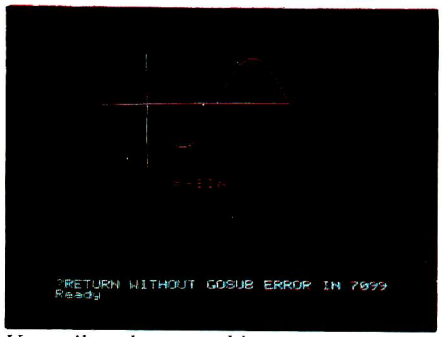








Rear view shows links to the outside world.



Versatile colour graphics

tunate because the Oric has no PRINT AT command. The manual gives a short machine code routine which allows the exclamation mark to be configured as a PRINT AT key, but it seems an astonishing oversight in a Basic which is generally very powerful and well designed.

And there's no doubt that this Basic is an extremely good implementation, with features often not found on considerably more expensive computers. As on the Spectrum, computed GOTOs and GOSUBs are supported — a line like GOTO A*100 is quite in order (always assuming you've given A a value earlier in the program!). Structured programming purists will be glad to see that you can GOTO or GOSUB a label; define COUNT as, say, 500 and you can quite happily GOSUB COUNT at any time. This makes renumbering of a program considerably easier; instead of having to go through the whole program line by line you simply change the initial value assigned to the subroutine. A word of warning to those reared on Sinclair Basic, however: the Oric requires that you hit line numbers exactly. On the Spectrum you can GOTO 499 even if there is no such line; execution will continue from the next line. On the Oric this will halt the program.

Generally, though, Oric Basic has more to recommend it than Sinclair's version. Other commands supported by Oric, but not by the Spectrum include REPEAT... UNTIL, DEEK and DOKE, CALL, DEF USR, FRE, IF... THEN...ELSE, LOG, ON...GOTO/GOSUB, SPC, TRON and TROFF, plus a few more that apply to HIRES mode only and are thus not strictly comparable.

REPEAT...UNTIL sets up a loop to repeat all program lines between the two statements until the condition specified by UNTIL is true.

DEEK and DOKE are exact equivalents of PEEK and POKE, except they work on two memory addresses at a time. Thus DOKE x, v stores INT(v/256) in location x+1 and the remainder goes in x.

CALL x transfers control to a machine code routine starting at address x.

DEF USR defines the start of a machine code routine.

FRE has two functions — FRE(0) returns the amount of memory available, while FRE("") forces variable garbage collection.

IF... THEN...ELSE executes all instructions following THEN if the expression following IF is true. If false these instructions are ignored and the program executes the instructions following ELSE. ELSE may be omitted, in which case program execution continues from the next line.

LOG returns base 10 logarithms. LN gives natural logs.

ON n GOSUB/GOTO x,y,z branches to the line number specified, depending on the value of n.

SPC(n) prints n number of spaces on screen. n is an integer in the range 0-255.

TRON (Trace On) is a useful debugging aid. As the program executes, line numbers are printed in square brackets on the screen in the order of execution. TROFF, as you would expect, simply turns the trace off again.

Random numbers are dealt with in three different ways. The standard format is A = RND(1)*6, in which case A will be given a random value between 0 and 5.9999. Repeating the instruction will give a different value for A. However, if the number in brackets is zero the value of A will again be between 0 and 5.9999, but this value will stay the same no matter how many times the instruction is repeated. If the number in brackets is negative then the random seed is set to a particular number and subsequent positive RND calls will always produce the same sequence.

There are two commands that are equivalent to the Spectrum's INKEY$ — GET and KEY$. GET strobes the keyboard and waits until a key is pressed; this is useful when displaying instructions on the screen, giving the user time to read the screen at his own pace before pressing any key to move on. KEY$ also strobes the keyboard, but does not wait. It takes the form X$ = KEY$, and must be preceded by a WAIT (n) program line, where n is a multiple of 10 ms. X$ will contain the value of any key pressed.

However, there are some strange omissions. As previously mentioned, there is no PRINT AT command but Oric Basic is also without any method of VERIFYing programs. As the cassette interface is very reliable this is not the problem it could have been but, being an extremely paranoid individual, it worries me when I can't check that the program on tape is the same as the program in memory. There is also no way of MERGEing Basic programs.

Graphics and sound

In addition to TEXT mode, there are three other modes available on the Oric — LORES0, LORES1 and HIRES.

For low-resolution graphics, TEXT mode can be retained, or the user can select either of the two LORES commands. The only difference between them is that LORES0 gives the standard character set while LORES1 selects the alternate, teletext graphics set. Although screen resolution is theoretically 28 lines of 40 characters, in most cases the far left column cannot be used as it contains the attribute controlling the background colour for each row. Colours can be set globally, using Sinclair-style INK and PAPER commands, or locally — in which case attributes are POKEd or PLOTted onto the screen. If colours are set globally, it should be noted that INK and PAPER will change the whole screen instantly, without needing a CLS command. When POKEing or PLOTting on screen, care should be taken to ensure that codes are entered at an area of the screen that is blank; failure to do this will mean that any character already there is overwritten and replaced by a space. When working in LORES0, the alternate characters can be accessed by using PRINT CHR$(9) and the standard set regained with CHR$(8).

In HIRES mode, the screen is divided into pixels with a resolution of 240 by 200. You are not limited in the number of colours displayed at any time, and the Oric gives more flexibility than does the Spectrum in changing colours. Each attribute will work on an area one character square in width by one pixel in depth — thus you can have 200 lines of alternating colours down the screen. The definition is generally very good, with each colour sharp and distinct. Characters can be plotted onto the high-resolution screen using CHAR, and there is provision for three lines of text to be entered at the bottom of the screen. Drawing on screen is simplicity itself. The cursor is moved to the relevant place with CURSET followed by the pixel co-ordinates and what is described in the manual as an 'FB' number. 'FB' stands for foreground or background, and thus lines or points can be plotted or erased. Relative moves are handled by CURMOV, which has the same syntax. CIRCLE draws what should be a circle but in fact appears to be an ellipse. Oric suports eight colours — the advertisements rather misleadingly claim 16 but in fact this just means eight foreground and eight background. There is only one level of brightness, but against this must be set the fact that the Oric is extremely flexible in dealing with different text formats — characters can be normal or double-sized, flashing or steady and this is achieved with the minimum of fuss by using the CTRL key.

It is easy to define your own characters, using either the standard or the alternate character set. Characters are unusual in that they're defined on an 8x6 grid, with the leftmost two columns always being blank.

For anyone used to the weedy BEEPs produced by the Spectrum as an excuse for sound and music, the Oric's sound facilities will come as a revelation. In addition to the arcade-style pre-programmed noises (PING, SHOOT, ZAP, EXPLODE), the Oric has three tone channels and a noise channel that can be manipulated to produce effects that are limited only by the user's imagination. With a range of six octaves, some very respectable music can be obtained.

Sound generation is controlled by the MUSIC, SOUND and PLAY commands — the output is defined with MUSIC or SOUND and the envelope is controlled by PLAY. The envelope determines the 'shape' of the sound, enabling you to decide whether it starts sharply like a guitar, or smoothly as on an organ. There are seven different envelope 'shapes' and some stunning effects can be achieved. The sound commands are relatively complex (although not as fiddly as on the BBC Micro, on which the 'Envelope' command takes 14 parameters!) but the results that can be achieved are well worth the time and experimentation involved. Volume can be set in SOUND and MUSIC statements in the range 1-15 (if 0 is entered the volume level is variable and will be controlled by the PLAY command) and this is more than

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adequate, with a level of 7 or 8 being plenty loud enough for all but the deaf. One thing you have to remember is to include a PLAY 0,0,0,0 program line — otherwise the last note played will continue indefinitely! Sound is definitely one of the Oric's strong points and, while not on a par with that of the BBC machine, could well be a deciding factor for someone who is hesitating between buying an Oric or a Spectrum.

Entering programs

Oric Basic makes the entering of programs very easy. All variables are pre-set to zero, and arrays are automatically allowed 11 elements — more if they are re-dimensioned. Spaces in program lines are not critical and Oric does not require LET when variables are assigned. It is also possible to omit the variable name after a NEXT statement, although this is not recommended as it is very easy to lose track of which particular loop you are dealing with. Multiple statement lines are allowed, but Oric does restrict line length to 78 characters.

The CTRL key can be used to keep the display tidy — CTRL-L clears the screen, CTRL-Q removes the flashing cursor, and CTRL-S turns off the display entirely. CTRL-T turns the caps lock on and off, and CTRL-D allows double-height characters to be entered — a very useful facility. In addition, CTRL-F turns off the keyboard bleep, CTRL-X deletes the line you are entering and sends the cursor to the beginning of the next line, while CTRL-] turns off the column protection for the far left column, thus giving a full 40 characters across. CTRL-C will stop program execution. All CTRL key actions can be duplicated in PRINT statements by using CHR$(x) where x is the number corresponding to the relevant letter — CHR$(4), for example, is equivalent to CTRL-D. All CTRL keys are toggle action — repeating the sequence cancels the command.

Editing is done in two ways — the line to be edited can be pulled out of the listing with EDIT line number, or the cursor can be moved to the relevant line with the arrow keys. The line is then copied by using CTRL-A, which moves the cursor along the line; parts that are to be changed are simply typed over. Deleting is achieved by skipping over the text with the cursor keys. To enter additional text you have to move the cursor to the line above and then type in the new information (it doesn't matter if you overwrite what's already there), before moving the cursor down again, backspacing to the point where the additional text started, and using CTRL-A to copy the rest of the line. It sounds complicated, but you soon get the hang of it. The manual ignores entering of new text in a program line entirely.

It is possible to enter programs in HIRES mode, but unless you are entering direct commands and want to see their effect as you do so it is better to stick to TEXT mode — in HIRES the listing is only visible on three line at the bottom of the screen and it scrolls so fast it's almost unreadable.

Listing is achieved with LIST (in which case the screen scrolls until the end of the listing is reached, but can be stopped at any time by pressing the space bar), LIST m-n (all lines between and including m and n are listed) and LIST n (line n alone is listed).

Numbers can be entered in either decimal or hex form — a hash mark preceding the figures will make the Oric accept it as a hexadecimal number — and conversions between the two number bases can be carried out directly using PRINT HEX$(16) (this will produce #10) or PRINT #10 (this gives 16). Upper limit for conversion is 65535 (FFFF).

Machine code programming is made easy by the CALL and DEF USR functions and the manual gives two examples which will configure the ! and @ keys to give PRINT AT and the vertical cursor position respectively. HIMEM sets the top of user memory (directly equivalent to Sinclair's RAMTOP) and enables machine code programs to be protected from overwriting by Basic. Machine code programs can be saved and loaded using CSAVE/CLOAD "PROGNAME", A,E where A is the start of the block of memory and E is the end address.

In general, the Oric is very forgiving when programs are entered and executed. The error messages are straightforward and unambiguous (there are 20 in all) and, despite the skimpy and inaccurate documentation, it should be relatively easy for the beginner to get started on writing his own programs.

Documentation

The Oric manual is a typical example of the curate's egg syndrome — there's a wealth of useful information in the various appendices and some very good material on mathematical functions, but generally the documentation does not go into sufficient detail and in some cases it is downright misleading.

The 'Better Basic' section persistently confuses colons and semi-colons and the 'Oric Basic' section, which give a brief rundown on commands and functions, has numerous — admittedly minor — mistakes that better proof-reading should have spotted.

As a quick reference guide, the appendices are excellent — they cover everything from a list of 6502 machine code instructions through to a very comprehensive 'Pin Output Chart' which explains the function of every pin on the various expansion ports at the rear of the machine.

However, a manual for this class of computer should really function as a Basic tutorial for beginners, and in this the Oric manual falls down. This is excellent news for the Tim Hartnells of this world — I foresee a flood of books designed to explain Oric Basic properly — but not so good for those on a limited budget. In general, the Oric manual is not as thorough as the Spectrum's and shows signs of being somewhat hastily produced.

Conclusions

First of all, let it be said that the Oric is an extremely good machine and one that represents extraordinarily good value for money. There's no doubt that it will prove to be a strong rival to the Spectrum in what is an extremely competitive sector of the market. Major plus-points are the built-in facilities for communicating with the outside world and the vastly more sophisticated sound capabilities.

That said, I think the Spectrum may be a better machine for the absolute beginner. The graphics facilities are easier to handle on Sinclair's machine and the Spectrum manual, though far from perfect, is considerably more helpful than Oric's effort. The Sinclair 'tokenised' keywords are also probably easier for the beginner. For anyone with a previous grounding in computers, though — a ZX81 owner, say, or a VIC-20 user who has grown tired of the restrictions imposed by the limited memory — the Oric should prove ideal.

I say 'should' advisedly, because the Oric as it stands has some glaring faults. In each of the four models I've looked at EPROMs have been installed in place of ROMs and the Basic has contained some annoying errors. I had assumed that all this would be corrected before machines were sent out to customers — indeed, as I've said in this review, I wish the company had waited until everything was bug-free before sending out even review machines.

But it appears that some Orics — I hope a small number only — have been sold through the Spectrum (no relation) retail chain and there are therefore people who are very probably beginners to computing who have walked into shops and bought what is basically a sub-standard product. Presumably Oric will replace these faulty models — under the Sale of Goods Act the customer is entitled to either a new machine or his/her money back — but it is a situation that should never have arisen in the first place.

GOTO page 231

Technical specifications

Processor	6502A
RAM	16k or 48k
ROM	16k
Keyboard	57 key, 'tactile feedback' ASCII, auto-repeat
Screen	Domestic TV; provision for RGB colour monitor
Disk	Microdrive, not yet available
Language	Basic in ROM

BENCHTEST

LSI M-FOUR

Jane Bird tackles a heavyweight British newcomer to the 16-bit market.

The M-Four is built by British micro manufacturer LSI, based in Woking, Surrey. The company intends it primarily as a single user system for business applications such as word-processing, stock control and accountancy. Other possibilities include instrumentation control. It is the centrepiece of a new family of machines anticipated by LSI.

In the beginning was the M-One, a single user business computer that ran only proprietary software. Then came the M-Two, a multi-user system, but also restricted to LSI's own software. Those two systems sacrifice the advantages of supporting a standard operating system such as CP/M with the abundance of associated software in favour of higher performance from proprietary software. LSI claims that the standard operating system for networks, MP/M, in particular, is less efficient for multi-users in a business environment than the company's own operating system.

With the 8-bit Z80-based M-Three LSI moved into general purpose desk-top machines. The M-Three was launched two and a half years ago and has sold nearly 3000 units to date. Its successor, the M-Four, which offers both an 8-bit Z80B processor (twice as fast as the Z80) and a 16-bit Intel 8088 which controls the Z80B, was first exhibited last September. Production got underway in January. About 50 had been sold at time of going to press.

The M-Four supports two standard operating systems, CP/M86/80 from Digital Research and MS-DOS from Microsoft. In addition it supports the not truly compatible 8-bit CP/M which actually runs on the 16-bit processor. The total system thus supports an enormous range of standard software.

According to LSI, this machine is only the first in a whole family of machines anticipated by the company. Rather than continually upgrade the M-Four the company expects to launch other machines in the range. Even so LSI may introduce an 8Mhz version in the future. (The 8088 functions at the standard 5MHz in the M-Four — the same speed as in the IBM Personal Computer and the Sirius.) Throughout, the priority with the M-Four is to keep price down as it is intended to be a single user system. For this reason, LSI has no plans to switch from the 8088 to the higher performing but much more expensive 8086. The latter, it thinks, is only really necessary for multi-user systems or number crunching applications. Intel's iapx 80186 will be used as the basis for a different machine in the family.

The Z80B is under the control of the 8088 in the M-Four. The system has 128 kbytes RAM with parity as standard and an option of 256 kbytes RAM. There is also a real-time clock and calender with battery back-up.

During the second half of this year we can expect to see other members of the family beginning to appear, with networking a major component of the new developments. Networks may include other processing units as well as M-Fours. In addition to MS-DOS and CP/M-86/80. LSI is currently implementing its M-Two multi-user software ELSIE on the M-Four. It is also implementing MP/M, against its better judgement, because of market demands.

Hardware

Perhaps I should explain the disturbing pattern of events that led up to the moment of Benchtesting the M-Four. It must have been way back last September that *PCW* first expressed interest in looking at the machine and there followed a fiasco of being sent two (or was it three?) M-Fours one after another, none of which worked. By the time we got a machine that lit up when you switched it on we had already lined up a whole lot of other micros to look at first and that is why you won't be reading this until March at the earliest. (When will manufacturers learn not to launch machines before they're working?) The machine I tested was a pre-production model which may excuse some of the defects. Once I did start to put the poor thing through its paces, I found that the keyboard had several duff keys — but more of that later.

The M-Four comes in two parts — the main unit houses two disk drives, a 24x80 screen and the processors; the keyboard is separate and plugs in at the front of the main unit.

The main unit is housed in mushroom-coloured polyurethane. But the final keyboard I received clashed horribly, being ivory pale. Apparently the production machines now come in a two-tone breed of the mushroom colour. The unit weighs a ton! Well actually it weighs 35 kg (77 lbs) including keyboard. It is also massive, being 642 mm wide and sporting a keyboard to match.

The disks are arranged vertically on the right hand side of the main unit, with the left hand drive housing the system disk. I tested an M-Four 250/4 series machine which gives a maximum formatted capacity of 2.4 Mbytes on its two 8in floppy drives. Other models offer 5¼in drives at the lower end or a 10 Mbyte winchester at the upper end.

The screen is to the left, with the qwerty keyset directly in front of it. In the centre of the main unit is the on/off switch and below that a badge bearing a billowing Union Jack to remind you where your heart was in buying the LSI machine.

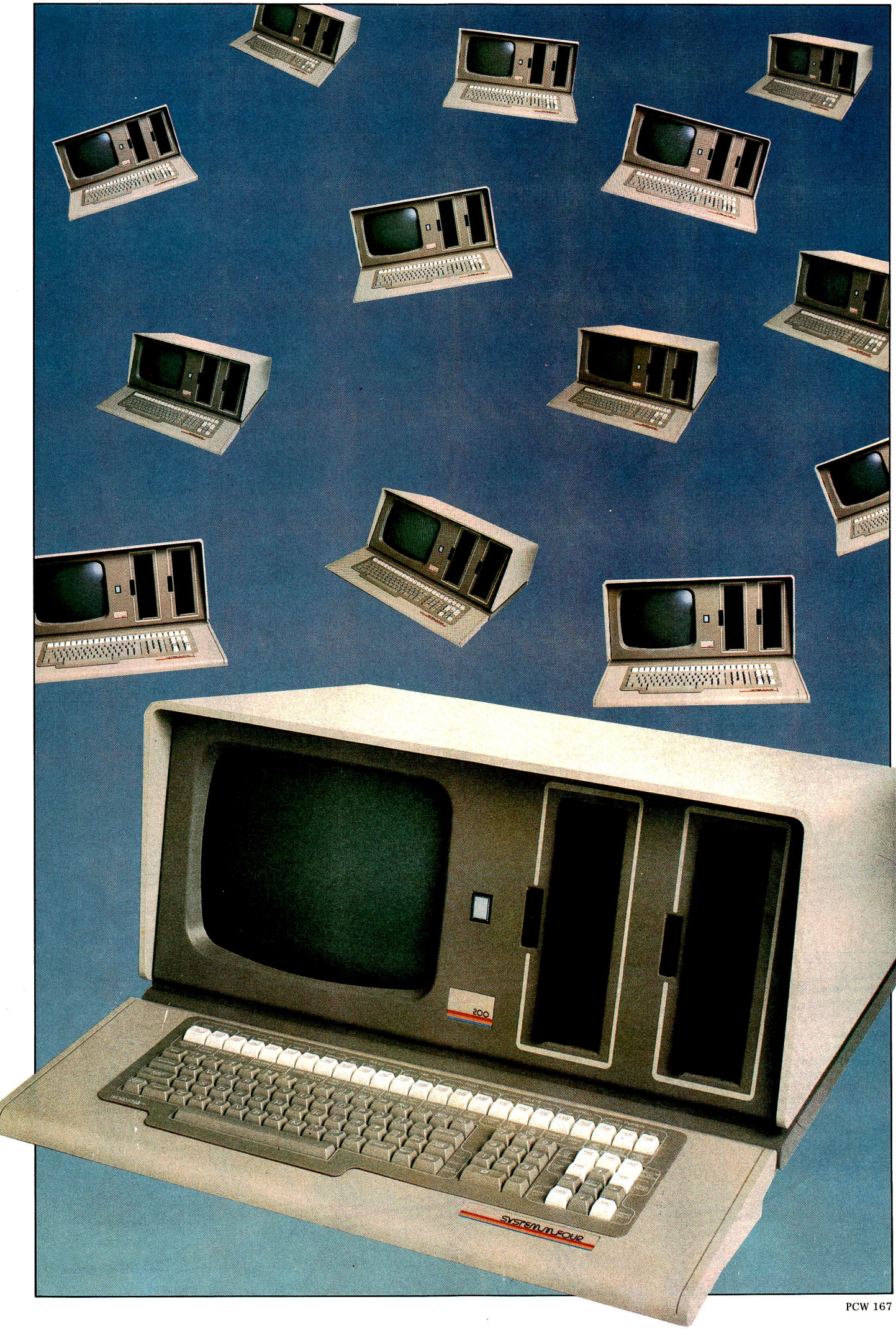
Beside the connector for the keyboard, at the bottom left hand side of the main unit, is a dial for controlling the contrast on the screen — but you can't control brightness. LSI dictates that the brightness has been 'preset during manufacture for optimum operating conditions'. In fact I found that brightness and contrast are satisfactory though the screen does have a sheen across it that tends to cause reflection. A gauze cover might alleviate this.

At the back are the interface plugs for connecting peripheral devices. My system had two standard RS232 serial ports with 25-way D-type connectors. It also had a parallel printer port with a 36-way Delta socket. The latter gives connection to any Centronics compatible parallel printer. Also available is an RS422 asynchronous/synchronous interface which you need for networking.

Removing the lid of the main unit to examine the innards of the machine was quite a challenge. The machine is sealed and solid as though it were expecting an armed raid, which is almost what you need to get in! Eventually I located some allen keys of the right dimensions and was able to remove the top which turned out to be excessively thick and strong. Should you so wish, you could easily stand on it, which is a resilience quite unecessary in a part of the machine that serves basically to keep the dust out of the components.

Inside, confirming all my suspicions, there is lots of empty space. It's almost as if LSI had built a big machine to give the purchaser the impression of buying lots of electronic goodies. Still, I suppose this make room for enhancement should LSI dream up some plans. The main processor board sits inside the bottom left of the machine. On it are clearly visible the 16 64k RAM chips in the 128 kbytes version with space for another 16 in the 256 kbyte model. (The Z80 can be programmed to use any block of 64k RAM within the main memory). You can also see the 8088, and the Z80B is located next to the PROMs in the middle of the board.

It is good news for fast servicing that the processor and memory are all mounted on the one board — allowing the whole lot to be swapped in and out at once. All the main processor and memory chips are socketed rather than soldered and could be yanked out with a screwdriver. This also facilitates



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maintenance by allowing you to switch chips in and out. The inside is a bit of a rats' nest on wiring but is not as bad as some I've seen. There was no obvious patching of last minute bugs and the overall effect is very clean. The power supply is also mounted on its own board but the strength and solidity of the thing is reminiscent more of a Victorian viaduct than a modern micro-computer!

Disks

Once you have switched on, the screen asks for a system disk to be inserted. This goes in the left hand drive: take care if you have to open the drive first by pressing the illuminated door button — the door springs back violently.

Inserting the disks is another clumsy task with this machine which has drive doors so hard to close that you have to concentrate real force into the fingertips and slam the doors across as if ramming home a winning goal. Once you've done this there emanates a pandemonium of clicking, clunking and thumping with deep echoes giving the impression of lofty caverns inside the machine. Each disk access is accompanied by a resounding clunk. It is bad that the drives keep the disks constantly spinning even when not in use since this tends to wear them out inside their jackets. It also promotes wear to the bearings of the drive — and drive B will keep spinning unused for a whole session if you don't need it. Other manufacturers provide auto cut-out after a few minutes if you don't access the disk.

Disk formats are unusually flexible on the M-Four — undoubtedly one of its finer points. Immediately after loading the system disk the screen presents details of available disk formats. The review machine restricted itself to double sided and double density for the left hand drive, but in addition to that could also handle double sided single density, single sided double density and single sided single density disks on the right hand drive. You specify which one you want by the prefix B:, C:, or D: respectively before the file name when accessing. The M-Four also reads IBM 3740 disk formats.

The maximum number of files allowed on a double sided 8 in disk for the M-Four is 256.

It was not very auspicious when the manual gave the incorrect information on how to switch on the system. 'Depress the "power-on" switch so that it lights up', it said. Unfortunately my machine switched on by means of a key and didn't have a light. When you switch on, the machine emits a high-pitched bleep just to let you know it's alive. The cooling fan also whirs into action and the M-Four starts off in the tradition it intends to follow as a rather noisy machine that likes to assert its presence.

Keyboard

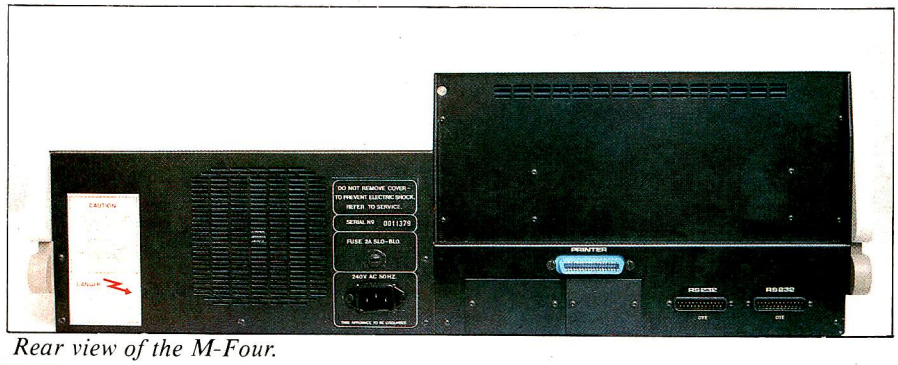
The keyboard has been carefully designed to be just as wide as the machine — a magnificent 642mm. This makes it almost totally impractical to rest the keyboard on your lap, although being an armchair programmer I persistently tried to do so.

A thick unwieldy piece of cable attaches the keyboard to the main unit. There is space underneath the keyboard to push in the spare cable but the whole arrangement is a bit primitive. It would be better with a flexible, coiled telephone-style cable to connect the two.

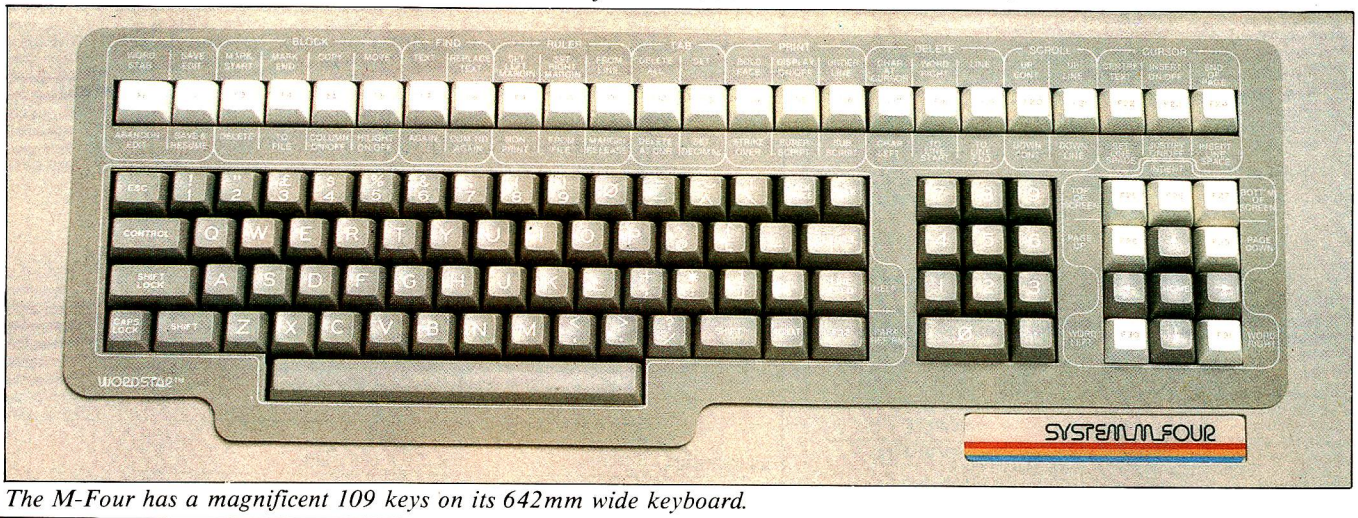
I also found that, although the keyboard is attached to the main processor by over 600 mms of cable, it is rather heavy and so long that if you try to use the qwerty part of the keyboard in a central part of your lap the whole thing cascades to the floor on your right!

The keys are grouped in three banks across the front, with a row of function keys across the back. The left hand bank is the standard qwerty keyboard, just to the right is the numeric pad and then further right again is a bank of function keys, a HOME key, and four cursor arrows. The arrows are much too far away and it is impossible to move the cursor about the screen without watching where you put your fingers on the keyboard. There are 24 function keys across the back of the keyboard which can be programmed to perform different functions in the SHIFT and normal positions. There are seven more to the right and one at the foot of the qwerty cluster, giving a total of 32 programmable function keys that can either be programmed by the user or by LSI as in the case of Wordstar. There are also 32 control codes which are addressed by using the CTRL key in conjunction with the alphabetic keys or @,[,/,],^, and . The control codes can be assigned to functions as dictated by the resident software. 'ESCape' generates the same control code as '[' but provides two keys for the same function — one either side of the keyboard — which can save time in use.

There is a caps lock as well as a shift lock. The caps key allows you to type everything in upper case but the top row of the qwerty cluster still generates numbers. It puts on line most of the keys you need to write a program (although unfortunately not brackets, inverted commas or $).



Rear view of the M-Four.



The M-Four has a magnificent 109 keys on its 642mm wide keyboard.

The main keybank includes both DELete and BACKSPACE keys. The DELete rubs out text immediately preceding the cursor, and the BACKSPACE simply moves the cursor backwards without affecting the text it traverses. According to the manual in some software the DELete key causes the same character to appear on the screen again, but either way it will be considered by the system to have been erased. Then there is a LINE FEED which corresponds to CTRL J and therefore gives quick access to the HELP menu when using Wordstar. BREAK is a special function key on the main section which generates code outside the ASCII range.

The numeric pad to the right generates the same ASCII codes as the qwerty cluster but is separated off for fast data entry.

The first keyboard I had included a raised pip on the central key of the numeric keypad for touch-key entry but the new keyboard seemed to have reneged on this useful idea and all numerics were smoothly indistinguishable to the touch. Confusion is certainly caused by the apostrophe key being indistinguishable from the comma key — both have the punctuation symbol marked in the lower part of the key and I kept forgetting which was which. In all the M-Four has a magnificent 109 keys!

If keys are held down for more than 0.5 seconds they repeat. The repeat key is said to operate about three times per second.

I mentioned earlier that the keyboard on the final machine turned out to be defective. This took some time to sink in. Incredulous at the apparent defect in the nth machine, I paused before pressing the offending keys 20 times without result. Then I took a deep breath, walked twice round the room, approached the machine gently and gave a perfect short, sharp jab. This produced a character — or rather several characters all the same.

It took LSI a little over 24 hours to deliver a new keyboard. Unfortunately this one had a defective shift lock which caused problems when using the Wordstar function key set — I kept accidentally saving the exiting Wordstar when I only wanted to save and resume, or deleting the character at the cursor when I wanted to delete the one to the left.

Operating system

The manual contains a partial guide to CP/M-86/80 which is the standard operating system for the M-Four. CP/M-86/80 maps out RAM into three areas: the main system management program modules, the system data, and the user programs and data (TPA). Within the first of these three areas are three main program modules, the console command processor (CCP) the basic disk operating system (BDOS) and the basic input/output system (BIOS). The CCP recognises the commands input by the user and initiates the appropriate program from within BDOS. BDOS calls BIOS if access to external data is required.

Programs from disk have to be loaded into RAM before they can be run. If they are to be run by the 16-bit processor then the space available to them in TPA is the total memory size (128 or 256 kbytes) minus the space occupied by the operating system — about 30 kbytes, depending on the release. If they are to be run by the 8-bit processor then they get 63 kbytes because the operating system resides outside the Z80 address space. The remaining 1k is taken up by the bare minimum of CP/M needed to accept the user program.

The M-Four also supports MS-DOS, which bears a remarkable resemblance to IBM Personal Computer DOS. This is hardly surprising since Microsoft wrote the IBM operating system! M-Four users will be able to benefit from the vast amount of software that will be, and indeed already has been, written for the IBM PC.

Software

The M-Four allows you to run 16-bit and 8-bit software without changing disks. Program files are identified by the file extensions .CMD for CP/M 86 and .COM for CP/M 80. In fact, CP/M80 programs are run in 16-bit mode under an 8-bit like environment. There isn't an 8-bit operating system sitting at the top of the 64k associated with the Z80B processor. It gets translated into CP/M86 sitting alongside the 64k on the Z80B.

LSI claims that its method of CP/M emulation is more efficient than other manufacturers' because it leaves 62.5 kbytes of TPA in the Z80B's RAM as opposed to about 52 kbytes of TPA left on a typical 8-bit machine. The Z80B also improves functionality over other machines because it operates at 5 MHz as opposed to 4MHz for the Z80A and 2.5MHz for the Z80. The larger amount of TPA allows programs with large databases to do large disc access. The spare memory can be used to hold the actual matrix, in SuperCalc for example.

Basic

Although LSI gives you interpreted Microsoft Basic for both CP/M-86/80 and for MS-DOS, the 8-bit Z80 compiled Basic is much faster than the MS-DOS Basic. This is because, to provide Basic on the 16-bit processor, Microsoft simply did a semi-automatic translation giving very poor 8086 code. The same thing has happened with Wordstar and LSI reckons that Wordstar on the 8-bit processor is 1.6 times as fast as the 16-bit version.

However, I had a more recent version of Microsoft Basic on the MS-DOS disk LSI sent than on the CP/M disk — 5.21 as opposed to 4.51. This created an anomalous situation. All the Benchmarks ran under MS-DOS at the same speed or slower than they did under CP/M-86/80. All, that is, except for Benchmark 8 which took 50.8 seconds under CP/M and only 29.2 under MS-DOS. A Basic compiler is also supplied under MS-DOS.

The screen is software-controlled on the M-Four so you can build display functions such as absolute cursor positioning and partial line erasure into your applications programs. The facility is intended to be used if you are designing a system to be used by operators working directly from the screens. When you write your application program you can include an ESCape H, for example, to move the cursor to the Home position in the top left hand corner and present your user with a completely screen. Other ESCape screen functions include ESC E to erase the screen, ESC J to erase the screen from the current cursor position to the end, and ESC A, B, C, D to move the cursor non-destructively up, down, right and left respectively.

The manual mentioned two other ESCape functions. There is the cursor address (ESC Y) and the graphics mode (ESC F). The cursor address supposedly allows you to move to a position using x,y co-ordinates. Graphics mode provides 32 graphics symbols using lower case alphabetics and six punctuation keys. Regrettably the manual refers the user to two appendices for further explanation of these facilities, but the appendices are not there — even in the final version of the manual!

You can store two different fonts in RAM at the same time — they take up 2k each — and these live in a file with the extension .FNT, and are loaded into RAM using the LOADFONT utility. You can then switch from one font to another in an application program by means of ESCape p. This displays all subsequent characters using the second 2k of font RAM, until it is switched off again by ESCape q. Under normal conditions the second 2k of font RAM contains the reverse video ASCII set so you could use ESCp and ESCq to toggle in and out of reverse video, giving clarity to applications on screen.

System utilities

There are three different aspects of the M-Four that the user can change: key programming, the character set displayed on the screen and system parameters. The last of these covers areas such as serial ports, logical/physical device assignment, cursor characteristics (flashing or steady, blocked or underlined) and the way the screen behaves in certain conditions like wrap-around at the end of a line.

The information relating to these aspects is stored in the following three different file types. .KEY .FNT and .PRM.

On your system disk you get three utility programs for generating and editing these

files. The programs are KEYGEN, FONTGEN and PARMGEN. These are interactive programs with a series of friendly and explanatory menus detailing how to use the utility. They are useful for generating the files the first time and also for going back to edit them later.

The first time you switch the system on it goes into AUTOEXEC.SUB as defined by LSI. But you can also create this file and edit it yourself.

LSI told me that the keyboard is delivered with a set of plastic overlays for the programmable function keys. The only overlay I had was for Wordstar and my main criticism of it is that it doesn't specify which set of functions are executed by holding down the SHIFT key in conjunction with the function key, and which functions are executed by holding down the function key alone. Of course, I eventually learnt that SHIFT was for the bottom set of functions and that if you didn't use it you'd get the top set executed instead. But all this took considerable time, trial and error and caused much annoyance. Also I kept forgetting every time I came back to the machine after a few days' break. LSI also intends to provide an overlay for the spreadsheet package SuperCalc and for its own Modular Accounting Package (Map). You can get hold of blank overlays for your own special function programming.

The set of functions you have programmed into the keys are stored in a special file identified on the directory by the file extension .KEY. You can have as many of these files as you like and you load whichever one you want into the system by typing its name from CP/M. There are 511 codes available to the function keys and, although they do not have to be shared equally, a complex sequence for one key will deprive the remainder.

KEYGEN is very friendly and leads you through a set of options. 'T' allows you to set an ERASE key other than BACK SPACE to help in a programmed key code sequence. 'R' is to call up a key function table which has already been created under KEYGEN. 'I' provides information on how to use KEYGEN and 'P' goes directly into key function programming mode. However, I found the utility much less friendly when it came to saving and exiting my KEYGEN file. When you have finished with the file you are given a two-option menu: 'A' to give the file a name and save it, or 'E' to abandon. Naturally you press 'A'. But the menu comes straight back and if you genuinely don't want to abandon the file you press 'A' again and go on looping the loop, conspicuously failing to get back into CP/M. Eventually I realised that after pressing 'A' to save, 'E' changed its meaning and became E to Exit to CP/M not E to abandon. So that needs tidying up.

KEYGEN is well laid out and at the top of the screen it displays a pictorial representation of the programmable keys with a pointer indicating which key you are currently programming and whether it is the SHIFT function (upwards arrow) or the normal function (downwards arrow).

A KEYGEN file is loaded into memory simply by typing LOADKEY followed by a space and then the filename.

The PARMGEN utility is for setting up the system's parameters such as baud rate, word length or cursor characteristics. Again it is organised in a friendly series of options. 'A' is for cursor personality, 'B' is for the serial port, 'C' is for logical/physical input/output device assignment; 'D' is to change drive B to single/double sided, and 'X' is to overwrite existing parameters.

Logically enough, a file that has been created under PARMGEN is loaded into memory with the system command LOADPARM followed by the filename.

Devising the font is the third aspect of the system that the user can manipulate, and it is the most fun, if not the most vital. FONTGEN allows you to create all your own characters for the entire ASCII key set. In the top left it provides a visual representation of each location available in the file. On the right is a diagram of the character cell and you switch bits in it on or off using an 'X' or a '.'. At the bottom left hand side of the screen is information giving you the location of the current character you are working on in both decimal and hex. I designed a hieroglyphic style font which was wonderfully spidery and spikey. It would have been a good font to use while writing a ghost story — I'm sure Mervyn Peake would have approved. Sadly, you would of course need a more than ordinary printer to actually produce the characters on a printed page. But you could wake up sleepy users by fixing it so that important messages suddenly appear on the screen in scrawly handwriting style! I also designed a graphics font but there was a problem remembering the ASCII locations of the graphics.

My only complaint about the FONTGEN utility relates to the display it provides of the existing character's font that you wish to edit (or blank set of locations waiting for characters in an empty file) eight pixels across and 13 down. If you think 13 is a strange number, it should be made clear that LSI wanted to have 14 with the extra line giving space for clarity between characters. However, the extra electronics involved in providing this would have added unacceptably to the cost of the system. The annoying thing here is that moving the cursor around the display of the font file has to be done using CTRL E, X, S, and D for up, down, left and right respectively.

I did hit another problem due to my own stupidity. I accidentally loaded an empty font file so that there was nothing on the screen. I could find no way out of this other than to switch the machine off and start again. I wonder what happens if you accidentally load an empty font file into your submit autoexec program! Which reminds me, one oddity of the M-Four is that it has no reset button!

Files created with FONTGEN are loaded with the LOADFONT command. This command has several options. As mentioned, you can have two fonts loaded at the same time, with Font 1 occupying the first 2kbytes and Font 2 occupying the second 2kbytes. By default, two fonts are loaded. But if you follow the LOADFONT command with /1 this loads Font 1 only, and /2 loads only Font 2. You can also use 'U' to underline the loaded font and 'R' to reverse the loaded font. You can compound these specifiers to create /1 R for example which loads in Font 1 in reverse video.

The other utilities on the system disk were FORMAT, HELP, TIME, PIP, RDCPM and STAT. These are all menu-driven and easy to use. HELP can be used for virtually anything on the system, but LSI seems to have lost interest halfway through the explanations. They go into things in some detail and at the end ask you if you want to see examples. I dutifully asked to see examples every time — but I never found any and always ended up back at the first HELP menu or back to CP/M.

An an example of the clear and unpompous way that HELP is written, look at the explanation of STAT. First you get a long paragraph describing the purpose of the STAT utility: 'To supply information about the disk drives, files and peripheral devices attached to the computer. STAT also changes attributes of files and devices . . .' and it goes on to explain the command line parameters. Then you are told that STAT gives you the free space 'in kbytes (1024 bytes or 1 k) for all online disks since CP/M was loaded'. It describes using STAT to set drives to Read/Write or Read Only, and how STAT VAL shows the possible external devices that can be assigned to your computer.

The manual also describes the utility DISCOPY but I did not find this on any of my system disks.

PIP is a standard CP/M utility to copy, combine and transfer files between peripherals. RDCPM allows you to read CP/M files from MS-DOS.

TIME refers to the real time clock system which tells you the date and time whenever you switch the system on. One pleasing feature about it is that you input the initial date and time in digits it is printed on the screen at the beginning of a session with the day of the week printed in English. Unfortunately my clock had a few

Benchmark timings

Benchmark 1	1.9
Benchmark 2	4.8
Benchmark 3	11.5
Benchmark 4	11.5
Benchmark 5	12.4
Benchmark 6	19.8
Benchmark 7	30.9
Benchmark 8	50.8

All timings in seconds. For an explanation and listing of the Benchmark programs, see PCW November 1982.

LSI M-FOUR

problems. On one occasion it told me, on booting the system, that it was 02.59.04 on Monday July 15th 2058!!! LSI assures me that the fault has been patched and now functions properly on production machines.

Conclusions

LSI regards the dual processor as the big selling point of this system and although a similar facility is available on the Digital Equipment Rainbow LSI claims to be in the lead with a machine that is up and running and in the marketplace. Also the Rainbow only uses a 4MHz Z80A. LSI says the M-Four is definitely faster than the Rainbow when running in 8-bit mode and the M-Four is also cheaper for the 128k version. (The Rainbow starts at a 64k version, which LSI thinks ridiculous for a 16-bit processor.) LSI also claims the M-Four is cheaper than IBM.

I did find my patience somewhat stretched with the reliability of the machine although the fact that I was testing a pre-production model probably gave me an unfair impression of the system before final bugs had been disguised.

Aesthetically, I thought it an ugly machine which takes up far too much space — especially since the M-Four is being marketed as a single user tool and therefore ought to sit easily on a desk top. It needs a table all of its own about 130cms wide to accommodate the main unit, keyboard and a small printer. It is also very deep, 683mm counting the main unit and keyboard together. The unwieldly bulk of the keyboard, and the long stretches involved, amount to a significant handicap.

Undoubtedly the major advantage of the M-Four is the amount of standard software it will support. Most people should be able to find a package to do more or less what they want under CP/M-86/80 or MS-DOS It is also useful to be able to use a variety of different density disks in the same drive.

On price it matches up respectably against the competition.

Technical specifications

CPU:	5MHz Z80B, 5MHZ 8088
RAM:	128k expandable to 256k
ROM:	4k bootstrap loader
I/O Ports:	Centronics parallel printer ports; 2xRS232 and 20mA Current loop async ports; General purpose interface bus — optional; RS422 serial port — optional.
Disks:	5¼in 8in
O/S:	CP/M-86/80, MS-DOS
Languages:	Wide range available under CP/M and MS-DOS

Prices

These prices apply to the LSI M-Four with 8088 and Z80B dual processors, 128k RAM, real time clock, Centronics printer interface, two RS232 interface ports, screen, keyboard, two disk drives and CP/M-86/80.

Model 150/4 (5¼in double sided drives, two 400k byte disks £2390

Model 250/4 (8in double sided drives with two 1.2Mbyte disks) £3475

Model 650/4 (10Mbyte winchester formatted capacity, 8in double sided with 2Mbytes) £4875

Model 160/4 (5¼in quadruple density double sided disks, not yet in production) no price available

Model 652/4 (21Mbyte winchester disk, 8in double sided disk) no price available.

Options

Extra 128kbytes RAM, one RS232 interface, one RS422 interface £500

MS-DOS £500

SPEEDING UP THE NASCOM

Listing continued from page 158

```
                1060 ; Finally, call PRINT routine to display
                1070 ; DE, then retrieve program pointer
                1080 ; into HL and jump back to the start.
OCAF CDEC0C     1100        CALL PRINT
OCB2 E1         1110        POP  HL
OCB3 18D4       1120        JR   START

                1140 ; String variable : 'Find variable'
                1150 ; routine leaves DE pointing to a
                1160 ; location which contains the length
                1170 ; of the string . The address of
                1180 ; the string is found at DE+1 and DE+2

OCB5 EB         1200 STRING EX   DE,HL
OCB6 46         1210        LD   B,(HL)
OCB7 23         1220        INC  HL
OCB8 23         1230        INC  HL
OCB9 7E         1240        LD   A,(HL)
OCBA 23         1250        INC  HL
OCBB 66         1260        LD   H,(HL)
OCBC 6F         1270        LD   L,A
                1290 ; HL now points to the start of the
                1300 ; string and B holds its length. The
                1310 ; following routine print the string.
                1320 ; NB. After printing the string, location
                1330 ; £10AD must be reset to 00, otherwise
                1340 ; a 'TYPE MISMATCH' error occurs.

OCBD AF         1360 LOOP1  XOR  A
OCBE B8         1370        CP   B
OCBF 2006       1380        JR   NZ,NOTEND
OCC1 32AD10     1390        LD   (£10AD),A
OCC4 E1         1400        POP  HL
OCC5 18C2       1410        JR   START
OCC7 7E         1420 NOTEND LD   A,(HL)
OCC8 F7         1430        RST  £30
OCC9 05         1440        DEC  B
OCCA 23         1450        INC  HL
OCCB 18F0       1460        JR   LOOP1

                1480 ; Number : Now to retrieve a direct
                1490 ; value. HL points to the start of the
                1500 ; number. First call routine to
                1510 ; convert number into 16 bit hex
                1520 ; in DE...

OCCD CDA5E9     1540 NUMBER CALL £E9A5

                1560 ; ...then print DE and jump back to
                1570 ; the start.

OCD0 CDEC0C     1590        CALL PRINT
OCD3 18B4       1600        JR   START

                1620 ; Quotes : This routine prints all
                1630 ; characters following the 'open quote'
                1640 ; until either a second quote or the
                1650 ; end of the line (00) is reached.

OCD5 23         1665 QUOTES INC  HL
OCD6 7E         1670 LOOP2  LD   A,(HL)
OCD7 FE22       1680        CP   ""
OCD9 2807       1690        JR   Z,ENDQUT
OCDB B7         1700        OR   A
OCDC 2813       1710        JR   Z,END
OCDE F7         1720        RST  £30
OCDF 23         1730        INC  HL
OCE0 18F4       1740        JR   LOOP2
OCE2 23         1750 ENDQUT INC  HL
OCE3 18A4       1760        JR   START

                1780 ; Space : This routine increments HL
                1790 ; until it points to a non-space
                1800 ; character.

OCE5 7E         1820 SPACE  LD   A,(HL)
OCE6 FE20       1830        CP   " "
OCE8 C0         1840        RET  NZ
OCE9 23         1850        INC  HL
OCEA 18F9       1860        JR   SPACE

                1880 ; Print : This routine prints DE in
                1890 ; hex while preserving HL

OCEC EB         1910 PRINT  EX   DE,HL

OCED DF66       1920        SCAL £66
OCEF EB         1930        EX   DE,HL
OCF0 C9         1940        RET
                1960 ; Finally, to end the routine, the
                1970 ; program pointer must be replaced on
                1980 ; stack pointing either to a ":" or
                1990 ; an "end of line" mark (00). Then
                2000 ; the return address is replaced
                2010 ; and a RET executed.

OCF1 E5         2030 END    PUSH HL
OCF2 DDE5       2040        PUSH IX
OCF4 C9         2050        RET
```

A WORD IN EDGEWAYS

Mark Holmes explains how to use the BBC Micro speech chips.

Having recently acquired the speech synthesis expansion for my BBC microcomputer and while beginning to understand the possibilities of the Event-handling facility, it occurred to me that these two aspects of the machine might be usefully combined in some interesting little projects.

Many readers will not be familiar with the speech expansion or the use of Events and so a brief description of each may be in order here.

The speech expansion involves the insertion of a pair of chips in sockets present on the main board, a couple of board modifications on issue 1, 2 or 3 boards and the presence of an 1.0 (or later) release operating system. Getting the machine to speak for you involves the use of the SOUND command in the form SOUND −1,n,0,0 from Basic or OSWORD call number 7 in machine code. Minus 1 as the first parameter is just an easier way of writing &FFFF; this in fact selects speech from a particular speech ROM in a particular fashion (but it is easier just to remember that −1 is speech at this stage). The second parameter should be an integer in the range 32 – 291, giving access to 95 different words. If the arithmetic seems in error here then I ought to point out that some words may be called with two different word numbers; this is because a number of words are given an ASCII code associated number as well as being in a strictly alphabetical list starting from 127.

The concept of the Event and the facility of Event-handling is one of the facets of the BBC micro which, when encountered by the irate user after having come across all the irritating aspects of Acorn marketing and production, placates him totally and leaves him thoroughly grateful for the innovative and creative talents of the design team. As many users will have learnt by now, the operating system of the BBC machine works by interrupting whatever is going on in the foreground (ie, the user program) every 50 milliseconds or so and sees to any work that needs doing by itself before handing back the processor to the user.

The background work that is seen to includes controlling the sound chip to the specifications of your fancy envelopes, storing the key strokes in your type-ahead buffer, keeping up with analogue to digital conversions, etc, etc. The Event is the way that the operating system allows the user to tack a little routine of his own on to the interrupt handling of the operating system which is executed when a certain event has occurred (hence the name). Readers may recall noting in their new User Guides *FX calls 13 and 14 which enable and disable entry into the user Event-handling routine when one of the seven Events is selected. The Events on offer are:

output buffer empty	0
input buffer full	1
character entering input buffer	2
analogue to digital conversion complete	3
start of vertical sync.	4
interval timer crossing zero	5
escape key pressed	6

*FX call 13 followed by the Event number disables Events and *FX14,n enables the selected Event. In machine code OSBYTE, calls may be used to the same effect. The interval timer is a separate clock to the system clock used for the TIME function in Basic but operates in much the same way, in that it is a five-byte value which is incremented every hundredth of a second. The interval timer may be written to or read by the user via OSWORD calls 3 (to read) and 4 (to write). An Event may be generated a specific time after the interval has been written to the timer. The Event is generated when the clock reaches zero and so the interval is specified by writing the time as a negative value in centiseconds and enabling the interval timer Event.

Control is handed to the user Event-handling routine via an indirection vector at locations &220 &221 (EVVEC), into which the entry address of the handling routine is inserted. The Event-handling routine is entered with interrupts disabled and should terminate with an RTS (return from subroutine) after no longer than about a millisecond; the User Guide also says that the processor's registers should be preserved. The user can apply any of the Events simultaneously, because on entry to the Event-handling routine the accumulator contains a REASON code which indicates the actual occurrence which caused the Event (the REASON codes are the same identifiers as used for the *FX calls) and the X and Y registers may contain additional information.

The first application that came to mind which would utilise the speech and Event facilities was a talking typewriter routine. Using the character entering input buffer

```
 10 OSWORD=&FFF1
 20 DIM MC% 100
 30 DIM sound_pars 8
 40 FOR I=0 TO 3 STEP3
 50   P%=MC%
 60   [
 70   OPT I
 80   PHP                        \ SAVE CONTENTS
 90   PHA                        \ OF REGISTERS
100   TXA
110   PHA
120   TYA
130   PHA
140   CPY #&30                   \ IF Y<ASC"0"
150   BMI exit                   \ GOTO exit
160   CPY #&7B                   \ IF Y>=ASC"{"
170   BPL exit                   \ GOTO exit
180   CPY #&3A                   \ IF Y<ASC"<COLON>"
190   BMI speak                  \ GOTO speak
200   CPY #&41                   \ IF Y<ASC"A"
210   BMI exit                   \ GOTO exit
220   CPY #&5B                   \ IF Y<ASC"["
230   BMI speak                  \ GOTO speak
240   CPY #&61                   \ IF Y<ASC"a"
250   BMI exit                   \ GOTO exit
260   CLC                        \ CLEAR CARRY
270   TYA                        \ TRANSFER Y TO A
280   SBC #&1F                   \ SUBTRACT &1F FROM A
290   TAY                        \ RETURN A TO Y
300   .speak STY sound_pars+2    \ PLACE WORD No. IN PAR.BLOCK
310   LDX #sound_pars AND 255    \ LO BYTE OF PAR.BLOCK
320   LDY #sound_pars DIV 256    \ HI BYTE OF PAR.BLOCK
330   LDA #7
340   JSR OSWORD                 \ SOUND-1,n,0,0
350   .exit PLA                  \ RESTORE REGISTER CONTENTS
360   TAY
370   PLA
380   TAX
390   PLA
400   PLP
410   RTS                        \ RETURN FROM EVENT HANDLER
420   ]
430   NEXT
440 ?&220=MC% AND  255
450 ?&221=MC% DIV 256
460 ?sound_pars=&FF:sound_pars?1=&FF
470 sound_pars?3=0:sound_pars!4=0
480 *FX14,2
```

Program 1

Event, which is in effect a keyboard stroke Event, it is possible to write a routine which responds to keys being pressed regardless of what else is going on, such as the input required by a program or editing a piece of text. I will give a fairly full description of how this routine was written as an example of the use of Events and speech.

Let us start with that part of the listing (Program 1) which is the actual assembler forming the Event-handling routine (ie, between the square brackets, lines 60 to 420). The command OPT I in line 70 is an assembler directive which controls the listing and reporting of errors during assembly of the machine code; the reader is referred to the User Guide for further information. The following six instructions save the processor's registers on the stack. The status register is pushed first, followed by the accumulator and the X and Y registers follow via the accumulator (it is not posible to push these onto the stack directly). These first instructions of the routine which save the register contents are complemented by the last five instructions before the RTS on line 410 which pull from the stack these saved values and restore the register contents before returning from the routine.

The 16 lines following the saving of the registers, lines 140 to 290 inclusive, perform a sequence of tests on the contents of the Y register. When the keyboard Event is generated, the Event-handling routine is entered with the Y register containing the ASCII value of the key pressed (something the User Guide fails to tell us). As I mentioned in the brief description of the speech facility, a subset of the words available has ASCII associated word numbers which include the letters of the alphabet associated with the upper case letters and the numbers 0 to 9 with appropriate ASCII codes for these digits. I decided to make the computer respond by saying which key had been pressed but ignoring punctuation characters, arithmetic symbols and control codes while not discriminating against upper or lower case letters.

First tests performed discard values less than hex 30 and greater than hex 7A by passing immediately to the exit from the routine; the keys I am interested in are all within these values. Anything less than hex 3A I can now pass directly to the speak routine because they must be digits, and after this anything less than hex 41 will be a symbol I have chosen to ignore. Subsequently values less than hex 5B will be the upper case letters and will be spoken directly. The final test removes the remaining values less than hex 61, which is another group of symbols which may be discarded, leaving me with the lower case letters from which I shall subtract hex 1F. This will convert them to their upper case equivalent, and the speak routine may then be entered by default.

The speak routine requires the invocation of an OSWORD call with the accumulator containing the value 7 and the X and Y registers containing the address (low byte, high byte respectively) of a parameter block containing the SOUND command parameters of the desired sound. The use of OSWORD calls is well documented in the new User Guide, but a brief description may be useful. The four parameters required for the SOUND command in Basic should be stored in a parameter block consisting of eight bytes, two bytes for each value, with the less significant byte of each parameter value being placed in the lower addressed byte of the pair (see Table 1).

Thus, to reproduce the speech command (SOUND −1,n,0,0) the parameter block is initialised with hex FF in the first two bytes of the parameter block and 0 in bytes 5 to 8. In my routine I am also able to initialise the fourth byte to zero because all the word numbers I require are less than hex 100. The parameter block is set up in the Basic which immediately follows the assembler part of the program.

Thus when I come to the speak routine I need only to insert my ASCII value into the third byte of the parameter block and set up my OSWORD call, after which the

sound_pars	first parameter	lo-byte	&FF
sound_pars+1		hi-byte	&FF
sound_pars+2	second parameter	lo-byte	n
sound_pars+3		hi-byte	&00
sound_pars+4	third parameter	lo-byte	&00
sound_pars+5		hi-byte	&00
sound_pars+6	fourth parameter	lo-byte	&00
sound_pars+7		hi-byte	&00

Which is equivalent to: SOUND −1,n,0,0 or SOUND &FFFF,n,0,0 (where n=n AND &FF)

Table 1

```
 10 OSWORD=&FFF1
 20 DIM MC% 100
 30 DIM sound_pars 8
 40 DIM clock_pars 5
 50 DIM words 100
 60 FOR I=0 TO 3 STEP3
 70   P%=MC%
 80   [
 90   OPT I
100   PHP                       \ SAVE REGISTERS
110   PHA
120   TXA
130   PHA
140   TYA
150   PHA
160   LDA #4
170   LDX #clock_pars AND 255
180   LDY #clock_pars DIV 256
190   JSR OSWORD                \ SET INTERVAL TIMER
200   LDY #&FF                  \ Y IS LOOP INDEX
210   .loop INY                 \ Y=Y+1
220   LDA (&80),Y               \ A=?((?&80+(?&81*&100))+Y)
230   CMP #0                    \ IF A=0
240   BEQ exit                  \ THEN GOTO exit
250   STA sound_pars+2          \ ELSE LO BYTE WORD No.
260   INY                       \ Y=Y+1
270   LDA (&80),Y               \ A=?((?&80+(?&81*&100))+Y)
280   STA sound_pars+3          \ HI BYTE WORD No.
290   TYA
300   PHA                       \ SAVE THE LOOP INDEX
310   LDX #sound_pars AND 255
320   LDY #sound_pars DIV 256
330   LDA #7
340   JSR OSWORD                \ SOUND-1,WORD No.,0,0
350   PLA
360   TAY                       \ RESTORE LOOP INDEX
370   JMP loop                  \ GOTO loop
380   .exit PLA                 \ RESTORE REGISTERS
390   TAY
400   PLA
410   TAX
420   PLA
430   PLP
440   RTS
450   ]
460   NEXT
470 ?&80=words AND 255
480 ?&81=words DIV 256
490 !words=&00D1010E
500 words!4=&00A000A4
510 words!8=&000000B3
520 clock_pars?4=&FF
530 !clock_pars=&FFFFF000
540 ?&220=(MC% AND  255)
550 ?&221=MC% DIV 256
560 ?sound_pars=&FF:sound_pars?1=&FF
570 sound_pars!4=0
580 *FX14,5
590 CALL MC%
```

Program 2

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A WORD IN EDGEWAYS

Event-handling routine can be left once the registers have been restored. Having assembled the machine code, all that is required is the initialising of the Event vector with the entry point of the Event-handling routine, the setting up of the parameter block as described above and the enabling of the keyboard Event with a *FX 14,2. All of this could be done by machine code but for clarity (and out of laziness) I have left it in Basic.

Program 2 introduces the use of the interval timer. The program is fairly puerile in that it makes the microcomputer announce that 'THIS IS AN ACORN COMPUTER' every 40 seconds or so. The more adventurous and young at heart may take pleasure in expanding this concept so that the computer selects randomly from a list of phrases and utters them at varying intervals (while father is typing in his program to average a list of numbers).

This program presents a number of problems and introduces a few new ideas. The interval timer needs to be set up at the beginning of the routine so as to reset the timer with each call. This is achieved using another OSWORD call, this time with the accumulator containing the value 4. A parameter block is required, now consisting of the five bytes which contain the value to be written to the clock and pointed to by the X and Y registers when the call is made. To allow access to all the available words in the speech ROM, both bytes of the second parameter of the sound command must be used and so values are poked into the fourth as well as the third bytes of the sound parameter block each time a word is to be spoken. A loop is used to pick up pairs of values from the vector 'words', using post-indexed indirect addressing, and so the routine works its way along the list until a value of zero is found in the less significant byte of a pair. In order to set the interval timer in the first instance the routine is CALLed from Basic the first time.

The final program (number three) uses the interval timer to create a timer counting down the minutes; when reaching ten seconds from time zero it counts down the last ten seconds. The listing is annotated so I won't discuss this one much further except to outline a couple of the problems faced when writing it. The timer is limited to a maximum of ten minutes because the routine uses a pretty simple method to generate the words from the count. Working only by intervals is a bit restricting because the interval needs to be changed in the progression from minutes to seconds. A better method would be to make use of the other clock available as an absolute timer and then examine it at regular intervals using the interval timer. This program scratches the surface, in my own inept fashion, of the possibilities of talking clocks and timers running in the background. The vocabulary offered by the initial issue speech ROM is certainly sufficient for a complete talking clock program.

```
 10 OSWORD=&FFF1
 20 OSBYTE=&FFF4
 30 DIM MC% &100
 40 DIM sound_pars 8
 50 DIM clock_pars 8
 60 DIM X% 100
 70 FOR I=0 TO 3 STEP3
 80   P%=MC%
 90   [
100   OPT I
110   PHP
120   PHA
130   TXA
140   PHA
150   TYA
160   PHA
170   LDA #4
180   LDX #clock_pars AND 255
190   LDY #clock_pars DIV 256
200   JSR OSWORD                  \ SET INTERVAL TIMER
210   LDA &80                     \ A=?&80
220   CLC                         \ CLEAR CARRY
230   ADC #&30                    \ A=A+&30(+CARRY)
240   CMP #&3A                    \ IF A=&3A
250   BNE not_ten                 \ GOTO not_ten
260   LDA #&21                    \ ELSE A=&21
270   .not_ten STA sound_pars+2   \ PLACE WORD No. IN PAR.BLOCK
280   LDX #sound_pars AND 255
290   LDY #sound_pars DIV 256
300   LDA #7
310   JSR OSWORD                  \ SOUND-1,WORD No.,0,0
320   DEC &80                     \ ?&80=?&80-1
330   LDA &80                     \ A=?80
340   CMP &81                     \ IF A=?&81
350   BEQ change_interval         \ GOTO change_interval
360   .exit PLA                   \ RESTORE REGISTERS
370   TAY
380   PLA
390   TAX
400   PLA
410   PLP
420   RTS                         \ RETURN
430   .change_interval
440   CMP #&FF                    \ IF A=&FF (i.e.IF ?&81=&FF)
450   BEQ disable                 \ GOTO disable (SEE LINE 530)
460   LDA #10                     \ A=10
470   STA &80                     \ ?&80=A
480   LDA #&EC                    \ A=&EC
490   STA clock_pars+1            \ 2nd BYTE OF clock_pars=A
500   LDA #&D8                    \ A=&D8
510   STA clock_pars              \ 1st BYTE OF clock_pars=A
520   LDA #&FF                    \ A=&FF
530   STA &81                     \ ?&81=A
540   LDX #clock_pars AND &FF
550   LDY #clock_pars DIV &100
560   LDA #4
570   JSR OSWORD                  \ CLOCK=-5000 (&FFFFFFD8EC)
580   LDA #&FF                    \ A=&FF
590   STA clock_pars+1            \ clock_pars?1=A
600   LDA #&9C                    \ A=&9C
610   STA clock_pars              \ ?clock_pars=A (PAR.BLOCK=-100)
620   JMP exit
630   .disable LDX #5
640   LDY #0
650   LDA #13
660   JSR OSBYTE                   \ *FX 13,5 (DISABLE TIMER EVENT)
670   JMP exit
680   ]
690   NEXT
700 ?&80=10
710 ?&81=&0
720 clock_pars?4=&FF
730 !clock_pars=&FFFFE890
740 ?&220=(MC% AND  255)
750 ?&221=MC% DIV 256
760 ?sound_pars=&FF:sound_pars?1=&FF:sound_pars?3=0
770 sound_pars!4=0
780 *FX14,5
790 CALL MC%
```

Program 3

For those people without the speech expansion but with a series 1 operating system it should be quite easy to alter these programs to generate simple sounds instead of speech. This can be achieved by altering the setting up of the parameter block used by the sound generating OSWORD call (incidentally, for more complex sounds there is an OSWORD call for creating ENVELOPEs). One thought that has occurred to me is what the effect of dynamic ENVELOPE change might have if performed while the SOUND is actually being generated; it could add a new dimension to exotic computer noises.

On a more general level, one of the more difficult to solve bugs I encountered when writing these routines occurred when I failed to DIMension enough space for the code I was producing and so ended up over-writing the end of my routine in odd ways. Overstaying one's welcome with overly long Event-handling routines also has some quite weird effects.

END

COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Len Warner (see 'Computer Answers' page). Address letters to: 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

The Root Letter

I thought you may like to know the most likely reason for the name of 'Root Computers' (February's 'Newsprint' under 'Rooting for Unix') It isn't anything to do with Unix installation. The Unix file systems (as you know) have a tree structure, the base of which is called the root directory; denoted by a '/' — and the user with all power on a Unix system, also known as the superuser has the log in name Root! He is user number 0 and has read/write permission over everything, so as root you can screw up the whole system.

Your piece on Bleasdale a while ago was interesting. He says he's got the only 'true' Unix system (Newsprint January 1983). I disagree. Xenix, which I've spent the past year bashing away on as a humble user, is, as far as I can see, Unix. I've also read a lot of Unix off the official distribution tape from Bell Labs, and the documentation is the same. Logica, which supplies Microsoft's Xenix, just photocopies the Bell manual. Yes the C compiler is a bit different due to the need to implement it on PDP 11/23 (no separate I and D space), but as far as I can see what goes for Unix goes for Xenix. The documentation is the same, and code off the Unix tape compiles and runs under Xenix. This isn't to say that Xenix is perfect (it can't do floating point arithmetic very well). Logica, or Microsoft, just took Unix, polished it a bit and that's it.

What the 'magic' test for the real Unix is I don't know. I can tell you some good ways to crash it — this may prove it's the real thing. I regard Unix 'look alikes' to be Onyx and Uniflex, Xenix *is* Unix. As for this confusion between the shell and the kernel; the shell is just a program, but a large very flexible one. The kernel contains all the system primitives — which are I/O drivers, routines, etc. Kernighan & Co state that only I/O routines should be machine-based, the rest should sit 'on-top', so as to be flexible as possible. The effect is to hide any device distinctions from the user so floppies, winchesters, etc, all merge to be device files which appear as the same sort of thing.

So you can write your own shell — it's just a program which allows you to run other programs. The real work is done by 'init' the father of all processes and the swapper. Strikes me you need some articles on Unix. The review of the Positron 9000 October 1982 wasn't too good on the Unix side — it says that true Unix doesn't allow processes to be locked in memory, but it does. There's a system call called lock.

(Name and address supplied)

A cry from the heart

I am writing to you in desperation (and in the hope of prodding BBC Microcomputer Ltd into life).

I have the usual BBC disaster story of extended deliveries, broken promises, etc, whilst waiting for a micro and cassette deck. I have suffered the misery of having to return three computers and three cassette machines as faulty, with a lethargic response to replacement in every case, and actually having two working components together for minimum periods.

I have been sent incorrect connecting leads, had faulty replacement units arrive after pleading by phone and post that they be tested before despatch, had my Access account charged for unordered goods, and have been without a (fourth) replacement cassette unit since November. I am now told that BBC cannot supply me and that I should contact a dealer on the list they provided. I did — and I should have known better.

Two had given up BBC dealership due to 'endless problems and inefficiency', two telephone numbers were wrong, six either had no machines available or were 'still assessing suitable models' despite advertisements in last November's magazines.

I cannot obtain a suitable machine with a tape counter that will operate via the micro. Can anyone help?

I am still getting computer-printed dockets advising me that my order for Acornsoft items is being processed (they arrived in December), and advising that I owe for items not ordered or received.

The common factor appears to be Vector Marketing (previously BL Marketing). I have a huge file of correspondence in which I have tried to write politely and intelligently to resolve my problems, and have received endless sidestepping replies from everyone from the Director to the office girl. I have asked about the serious MOS bugs in the micro, but received no reply. I am not amused to hear that I may have to pay to bring my computer up to its advertised specification.

I have spent, I estimate, in excess of £35 in phone calls, being shunted around BBC London and Kettering, Vector and BL Marketing, Acorn Cambridge, Retail Control Systems, etc, not to mention the time wasted phoning constantly engaged numbers. The BBC do not seem to acknowledge their responsibilities under the Sale of Goods Act as retailer, and continually want to pass one on to yet another person who cannot actually do anything.

To sum up, a year has passed, I have had enough, and lost all interest in programming, etc. I was a newcomer to microcomputing, although as a qualified electrical engineer not too naive, I hope. All I want to achieve now is to get the damned thing up and running so that my son can play games on it.

I'm told the BBC is a great machine, and I'm sure it is when it works and I can obtain a cassette deck that doesn't self-destruct. Certainly the Acornsoft cassettes I have are superb. But whenever I talk to fellow Model B owners, I find mine is a far from isolated experience.

So to newcomers who do not want to tread the path of suicidal rage and ultimate frustration, may I suggest you only buy a micro if you can get it over the counter of a local shop complete with hardware — and test it *before* you take it home!

David Elsworth, Maidstone, Kent

PS. My computer is on the blink again.

Waiting for Mephisto

I was very surprised when I read your article regarding the new Prestige model that no mention was made about the extra facilities provided by this model. I wrote to Mr Renaldo some time ago regarding any new developments, and I suggested perhaps the Sensory '9' could be improved along the lines of the new Conchess computer (is this anything to do with Fidelity, or who makes it?) Like thinking move and anticipated response, depth of ply search, rating the position, and special mate level. He suggested I contact *Computer & Video Games* (passed the buck).

Since then I have managed to look at a brochure for the Prestige, and lo and behold — depth of ply, think move and reply, etc, also a clock display.

Whenever I see a recorded computer game, I see if my own computer will follow along the same lines. (I possess Voice Champion, Sensory '9' and Mephisto. The Mark 'V' I returned because of continual surge problems with the electricity.) Sensory '9' on Level 8 made the same moves from move number 9, except the Queen swap move (12) and the Knight move, it went for the human move of Rook swap move (25). But the real difference was at the end which was Q-c6 move (49); it also lit up M/i/4. I personally consider this a better move than the Prestige move.

When are we going to see the Advanced Chess module for the '9'? It is shown on the box, or is this a fudge?

When you get around to assessing the Mephisto, could you tell me when the edge connector is going to be used? I wrote to Hegener & Glazer, and they said it was for a TV interface to be provided later. But when, and how much? I know they used it on the BBC2 Master Games last year, because occasionally the word 'Mephisto' appeared on the screen. Also when am I going to see the update Module III?

Keep those very readable articles coming.

Frank Holt, Portsmouth.

Read next month's column — Tony Harrington.

Prestigious moves

As an enthusiastic follower of computer chess over the last few years, I much enjoyed 'Microchess' in the February '83 issue.

I assumed that Black's move 28 was Bd4 but am baffled by the Prestige's move 46. This is a mate in three position but Prestige seems to have missed it completely! How come?

Alan Wright, Gloucester

There are, in fact, two different mates in three — namely R-g7 and R-e7 — David Levy.

Prophet margin

Having just read Mike Liardet's review of the Prophet 2, I cannot agree with his conclusion that this system merits serious consideration. Not that there's anything wrong with the system itself — it's just vastly overpriced!

The heart of the system would appear to be a basic Atom, with 32k RAM expansion and a modified version of Acorn's own spreadsheet ROM, AtomCalc. As an experienced Atom and AtomCalc user, I would suggest the following system (the prices shown are not necessarily RRP, but are those prevailing, and are VAT-inclusive):

Basic Atom (with all manuals)	156.00
PSU	8.00
64k Expansion	70.00
Pearlcorder	60.00
B/W TV	50.00
F.Point ROM	23.00
AtomCalc ROM (with manual)	40.00
Metal case (with on/off switch)	34.00
Total system price	**£407.00**

Some of the Prophet's facilities would not be available. These are: search, conditionals, comparison, screens and superfast cursor. However, set against the Prophet's asking price of £914.00 (inc VAT), the above system represents far better value for money and, since the 64k expansion is seen effectively as two 32k pages, one could, with the minimum of fuss, have two separate sheets resident at the same time. Indeed, you could include Acorn's disk pack (£345.00) and still save £160.00, whilst overcoming the cassette filing problem.

I am pleased to see the Atom being promoted in a business environment, but not at Prophet's profit (sorry!) margin.

Barry Pickles, Manchester

Satellite tracking

One of the most frustrating situations in the use of microcomputers is the sudden discovery, half-way through writing a program, that the machine which can supposedly maintain a nuclear power plant lacks a very basic mathematical function. Arc sine, Arc cos, and Arc tan are good cases in point. The Sinclairs and the BBC apparently possess these functions, but the UK 101 has only Arc tan, and many micros ignore all three.

If you are attempting to track the 'amateur' satellite Oscar-9 or engaging in similar trigonometric exercises, the absence of these functions makes your micro worse than useless.

However, all is not lost. The following short routine will nest this capability into your program by making use of the sine, cosine, and tan functions already present. (Although the listing shows sine only — for cos and tan make the appropriate substitution.)

If N is the sine of X degrees:

```
10 INPUT: N
20 LET X = 0
30 LET Y = SIN(X)
40 IF ABS(N-Y)<0.001
THEN 70
50 X = X + 0.001
60 GOTO 30
70 PRINT (X * 57.296)
```

For results in radians, simply change 70 to PRINT X. The accuracy can be increased by adding more 0s in lines 40 and 50.

John Evans, Farnham, Surrey

Not-so-super Sage?

Reference to your Pascal Benchmarks shows that despite its MC68000 CPU the 'super-fast' Sage II is no faster than the five-year-old single-board Western Digital Microengine. Indeed, in the benchmarks involving reals, it is only half as fast because it doesn't even have a hardware floating-point facility.

Even with compilation to n-code, the benchmarks show that the 8MHz Sage is only about twice as fast as a 4MHz Z80 running the Pro-Pascal compiler.

So where have the advantages of a powerful instruction set and 2-byte words gone?

In other words, why isn't the Sage a lot 'super-faster'?

Jim Hawkins, Castletown, Isle of Man.

Infinite precision

I have just read the review of DataPrism (*PCW* March 1983) and note that of the 'Calculations. . . only one of the totals was correct'. Kathy Lang should investigate and report on the form in which numbers are stored and their associated numeric precision. If numbers are stored in floating point form with four bytes allocated to each one, one for exponent and three for fraction, the precision is only about 6½ decimal digits, equivalent to totals accurate to 1p in a maximum of £9999.99. dBase II on the Sirius claims accuracy to ten decimal digits but this is still a limit of 1p in £99,999,999.99. My company has recently received a specification calling for some totals to be accurate to 1p in £9,999,999,999.99 which is twelve digits. A question all users of database software should ask, if they also have calculations to perform, is: what is the maximum money total which can be used and remain accurate to 1p? The answer should appear in all future reviews.

D A H Brown, Malvern, Worcs.

Audiofax?

Under the BBC's Computer Literacy Project, software is to be transmitted on Ceefax. This means that to receive it, the user has to buy a Ceefax receiver/decoder. That recommended as part of the BBC Microcomputer System is the teletext receiver which costs £225.

I have written to the BBC asking why (since programs can be held on a conventional audio tape recorder) the telesoftware could not be transmitted instead on a sound channel, whether TV or radio. This could be done outside normal broadcasting hours.

In his reply, Mr Lawson J Brown, the Ceefax Telesoftware Organiser, states that Ceefax gives the user several advantages: reliable error detection; ability to re-acquire corrupted data; and the facility to have access to the software over a long period of time.

No doubt these arguments are valid; but why could the software not be put out *additionally* on UHF/FM, one of whose attributes is reduction of interference? Would other readers who also would like telesoftware without the extra expense please indicate support by writing to the BBC.

Malcolm Wintle, Bedhampton, Hants

ALL IN THE FAMILY

CODING FAMILY RELATIONSHIPS

Genealogy is a 'natural' application for micros, as A Sandison reports.

Computerised filing and retrieval techniques are particularly appropriate for the large quantities of data involved in tracing a family tree or in transcribing and indexing such documents as parish registers, wills or old census records. In all such files, the relationships between individuals are important facets of the information to be manipulated. Any one individual record, whether in a family tree, a baptismal certificate or a will, nearly always contains several names of people. It is very much easier to retrieve the particular record required if the parents, the children, the witnesses, etc, are identified as such.

My own family records, for example, contain some 200 John Sandisons, of whom 20 had Alexander as the father's name and nine had it as a son's name. The ability to search simultaneously for records containing both names reduces the 'noise' of irrelevant entries by 90 percent. But ability in such a search to distinguish easily the sons from the parents can halve the remaining 'noise'.

Similar relationships can be important in some business contexts, where the levels of organisational hierarchy simulate the generations on a family tree, and responsibility simulates descent, with 'opposite numbers' equivalent to cousins.

Types of relationship

In my searches, the generation difference can be of major relevance. In looking for a father/son pair, the search should not exclude grandfather/father or son/grandson pairs. Beyond the direct lines of descent, the in-law, step, foster and adoptive relations need separate consideration.

Another most important feature of all relationships is their reversibility: father-son is the reverse of son-father. Searching for Johns with sons Alexander means looking for sons on all records for Johns. Unless you are absolutely certain that every cross-reference has been made, a search for fathers in all records for Alexander could also be worthwhile.

Coding is a well-established device for saving computer memory and ensuring interchangeability of data between systems. Perhaps the best known computer codes are those in the ASCII system for identifying printable and control characters. A useful feature is the easy conversion from capitals to lower case by adding 32 (20 hex) to the numeric equivalent. Similarly, absolute values are converted to the printable digits by adding 48 (30 hex).

Random ASCII codes

Several similar opportunities have been missed and codes for other groups of symbols are allocated in a surprisingly random manner. The main mathematical symbols surround the numerals but are intermingled with colon and semicolon. Any attempt to discover whether a string is entirely mathematical has to search for those two punctuation marks separately within the range '(' at 40 (28 hex) to '>' at 62 (3E hex). Likewise, the punctuation marks are scattered over the whole printable character range from 32 (21 hex) to 63 (3F hex). This makes routines to check whether the spaces following punctuation are normal quite unnecessarily complex as each mark has to be searched for individually. These deficiencies just show how much detailed thought should be given to all the possible applications before any standard coding scheme is adopted.

As far as the genealogy searching is concerned the search routines would be greatly simplified if the coding is carefully designed to recognise relationships between items in the same manner as ASCII codes recognise the need to swap upper and lower case.

Family relations

Table 1 sets out the main relationships in family records. Note the reversed links shown, the fact that for some links the same term (eg, spouse) can be used for both directions, and that all are referenced from someone else, best considered as the 'subject' of the record. Note also that many of the terms (eg, aunt) imply the sex of the relation. Some non-familial relationships likely to occur in wills and households are also shown.

Filing needs

Most data filing programs use 'fixed-length fields', identified by their exact location in memory, to store different types of information. For family records this is both extravagant of memory and restrictive, because for some individuals information is full and detailed while for others it is notable mainly for its absence. I know of one man who married twice with 16 children in all: but I know no more about his mother than her name.

Providing a fixed field for every individual for a second marriage can only mean that it will be unoccupied in most of the records — even the first marriage field is empty for a substantial proportion. But more than two marriages cannot be ignored. Similarly, Pat Ash's names occupy as much memory as Gwendolyn Millicent Marjoribanks's.

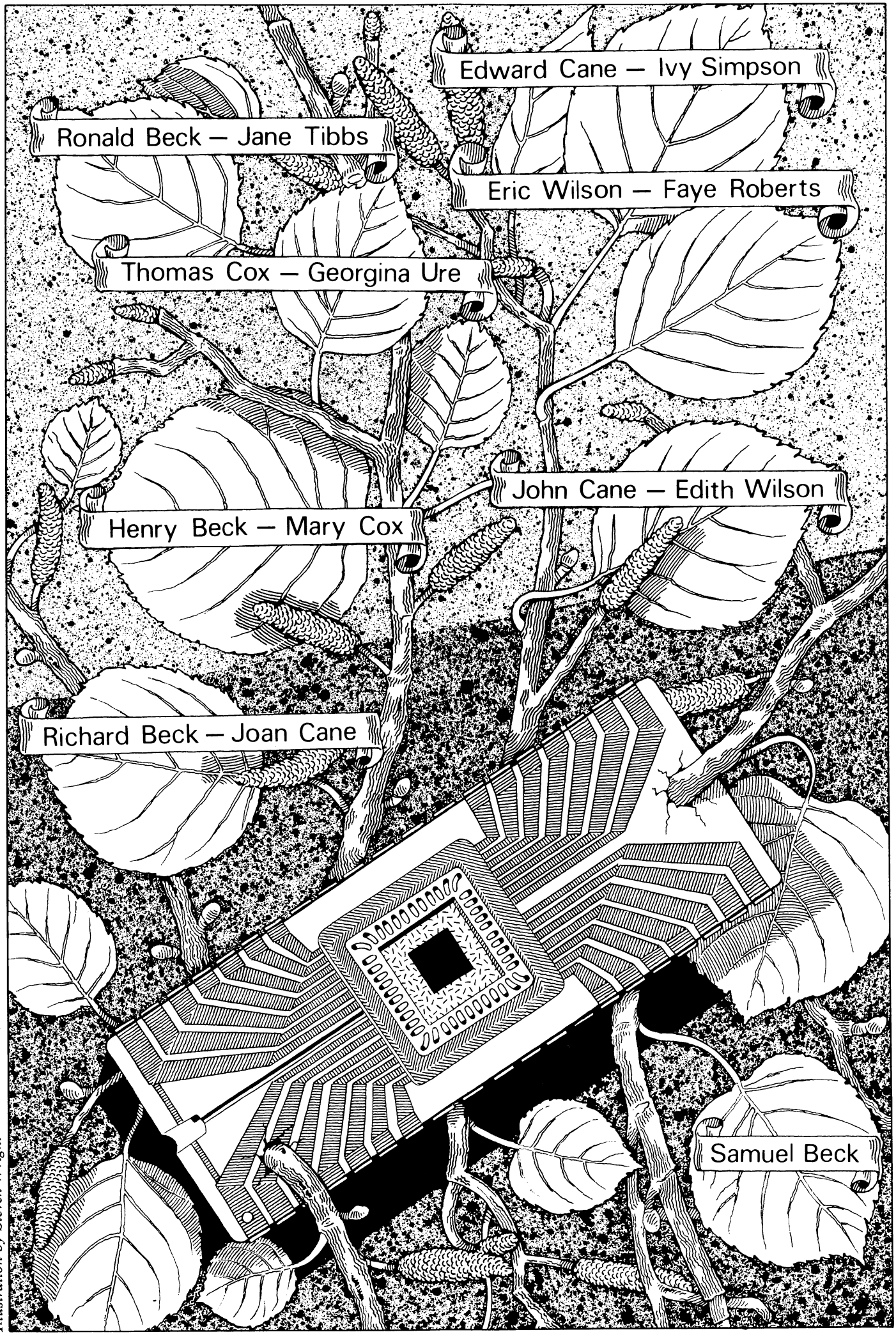
The other main filing system uses 'variable-length fields' and identifies each type of information by a 'flag', the length of which has to be added to that of every occupied field — but empty fields can be omitted altogether. Good family and business files should always record the sex of every individual mentioned, because very few forenames are really reliable indicators. Because most relationships imply sex, that information can be incorporated in a relationship field.

Coding needs

There seems therefore considerable scope for designing a system of relationship codes, either in the flag for a variable-length, or within a fixed-length, name field. First, it should be easy to identify, and reverse, the sex. Secondly, it should also be easy to reverse the relationships. Thirdly, generation differences should be consistently conveyed. And fourthly, those of direct

KIN (incl in-laws, step, etc)		NON-KIN	
Spouse		Friend	
Sibling		Colleague	
Cousin		Other	
Parent	Child	Godparent	Godchild
Grandparent	Grandchild	Signatory	Witness
Uncle, Aunt	Nephew, Niece	Employer	Servant
Great-uncle,	Great-nephew	Client	Lawyer, etc
Great-aunt	Great-niece	Patient	Doctor, etc
		Communicant	Priest, Incumbent
		Testator, Donor	Beneficiary
		Landlord, Host	Tenant, Lodger, Visitor

Table 1 Personal relationships



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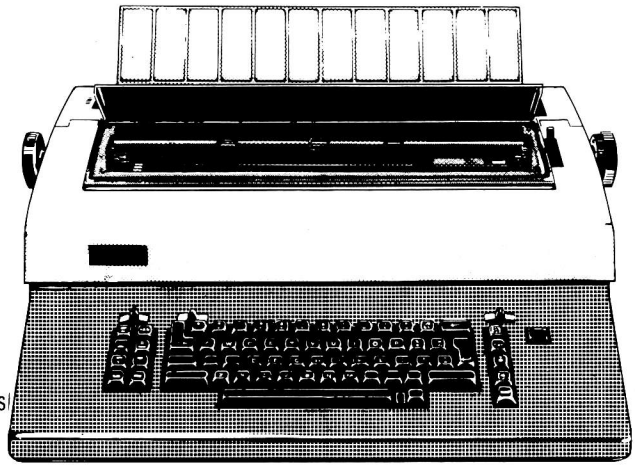

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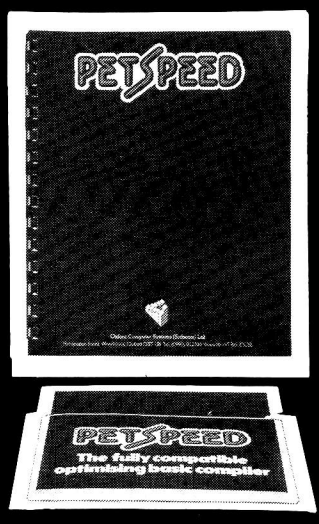

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ALL IN THE FAMILY

descent, the in-laws, the steps, and so on, should be associated.

Table 2 sets out a suggested scheme. I should emphasise that at this stage it is no more than a suggestion on which comments are invited. It is most important that no opportunities should be missed. We must proceed slowly. But when comments have been received and studied it should be possible to make positive recommendations.

The codes suggested are shown both as positive or negative numbers and as upper or lower case letters, grouped around that for the 'subject of the record' at zero, 'O' or 'o'. The letters can be used for print or display, the numbers for manipulation. Upper case is used for males, lower case for females. As a result, the sex indication can be reversed by adding or subtracting 32 (20 hex). Many standard retrieval programs can use or ignore case differences at will: this is instantly adaptable to sex differences. But it does restrict the number of possible relationships to 15 on either side of zero, or 31 in all. My personal view is that this should not be so restrictive as to invalidate the easy sex indication.

Coding patterns

When entering data from one source entry into records for each of the individuals named, relationships often have to be reversed. For example, data from a baptismal record goes into the child's record exactly as it is in the source, with references to the father and mother. But when the same data goes into the father's record, the parental relationship of 'father' must be reversed to 'son', and of 'mother' changed to 'wife'. The changes involved follow consistent patterns, most of which can be automated by a program provided the coding matches those patterns so far as possible.

To achieve this, the codes for reversed relations are placed equidistantly on opposite sides of zero, so that changing the sign of any code will reverse the relationship. Those terms which remain the same when reversed all imply the same generation and are set within the range -3 to +3. Other terms are grouped by the categories of relationship which imply the directness of the descent. Non-familial terms which carry no implications of descent at all, are placed beyond ±11. The group numbers can be used to lead to interactive routines to cope with such changes as son's mother to father's wife, wife to brother's sister-in-law, and so on.

Within each of the categories representing kin, a unit increase in the value of the numerical code represents one generation of descent, providing for five generations from grandparent, through parent, subject, child to grandchild. Few documents exceed that range in the people mentioned and personal records get far too complicated if they go beyond parents and children. The occasional references to great-grands can be coded as grands provided this wider meaning is remembered when search results are interpreted.

Code conversion routines

A major reason for structuring the codes in this sort of way is to simplify programs for coding and searching. The Basic routines set out below show that short routines have been achieved.

Category	Relationship	Codes*			Relationship	Codes*		
0	Subject of entry, record, etc	0	O	o				
1	Cousin	+1	P	p				
	Spouse	+2	Q	q				
					Friend	-1	N	n
					Other	-2	M	m
	Sibling	+3	R	r	Sibling-in-law	-3	L	l
2 Direct descent	Child	+4	S	s	Parent	-4	K	k
	Grandchild	+5	T	t	Grandparent	-5	J	j
3 In-laws	Child-in-law	+6	U	u	Parent-in-law	-6	I	i
	Gndchild-in-law	+7	V	v	Gndparent-in-law	-7	H	h
4 Step-relations †	Step-child	+8	W	w	Step-parent	-8	G	g
	Step-gndchild	+9	X	x	Step-gndparent	-9	F	f
5 Collaterals	Nephew/Niece	+10	Y	y	Aunt/Uncle	-10	E	e
	Grt-nphw/Grt-nce	+11	Z	z	Grt-aunt/Grt-uncle	-11	D	d
6 Non-kin §	Godchild/Signatory	+12	[	{	Godparent/Witness	-12	C	c
	Servant	+13	\	|	Employer	-13	B	b
	Client, etc	+14	]	}	Prof'l adviser	-14	A	a
	Lodger/Visitor	+15	^	~	Landlord/Host	-15	@	`

* Capitals for males, lower case for females.
† Step-, foster and adoptive relationships.
§ Relationships — not, of course, occupations.

Table 2 Suggested codes for relationships between individuals

As already suggested, the letter codes are filed, displayed or printed; but for manipulation the numeric equivalents are used, with a sex indicator. Translation between alphabetic and numeric is straightforward:

```
10 REM Printable codes in P$,
20 REM numeric in C,
30 REM male as S=0, female S=32
40 REM Printable to Numeric
50 C=ASC(P$)-79
60 IF C>15 THEN S=32: C=C-S
70 RETURN
80 REM Numeric to Printable
90 P$=CHAR$(C+S+79): RETURN
```

Changing from male to female could hardly be easier:

```
100 REM Sex reversal
110 IF S=32 THEN S=0: RETURN
120 S=32: RETURN
```

Relationship reversal is a little more complicated, but not much:

```
130 REM Reversing relationship code
140 REM S1 is the 'Subject's' sex
150 REM his code by definition is 0;
160 REM C, S for a related person.
170 Z=S: S=S1: S1=Z
180 IF ABS(C)>3 THEN C=-C
190 RETURN
```

Some relationship changes involve a shift from one category to another (as with mother to wife). The category group number can lead to another routine, which may have to be interactive. It can be calculated as follows:

```
200 REM Get category group as G
210 IF C=0 THEN G=0: RETURN
220 Z=ABS(C): IF Z<4 THEN
    G=1: RETURN
230 G=INT((Z-2)/2)+1: IF G>6
    THEN G=6
240 RETURN
```

Many familial relations involve generation gaps. The difference from the subject's generation can be expressed betwen -2 and +2, as follows:

```
250 REM Get generation difference in D
260 REM C, G, as above
270 IF G<2 OR G=6 THEN
    D=0: RETURN
280 D=SGN(C)*(ABS(C)-2*(G-1)-1):
    RETURN
```

Standard for the future?

I hope that these sample routines demonstrate the advantages of a structured scheme of codes. Its full advantages can, of course, only be realised in programs specially written with its features in mind. Some existing variable-length field file management packets allow the operator to select his own field identification flags. With such programs, codes on these lines can be used with immediate advantages: both in searching and in exchangeability of data between systems.

The aim of this paper is to spark off trains of thought. If you can see snags or can make constructive suggestions to improve or simplify the scheme, please write to me, c/o the Editor, in the next few weeks. I hope that in due course, the Society of Genealogists will be able to recommend a scheme more or less on these lines for adoption in genealogical programs.

END

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CHECKOUT

PETSPEED

Gordon Gilmore assesses whether Petspeed really is fast enough for the human race.

'Fast enough for the human race' is how the Oxford Computer Systems advertisement describes Petspeed, the optimising compiler for CBM Basic programs. Petspeed compiled programs are claimed to be up to 40 times faster than the Basic program, including disk operations. (Earlier advertisements promised 'only' 30 times improvement.) How realistic are these claims and how does Petspeed manage it?

The program is supplied on disk in either 4040 or 8050 format as required, together with a 'dongle' for the cassette port at the rear of the machine. There can be few programs as easy to use. Put the Petspeed disk in drive 0, a disk containing the program to be compiled in drive 1, then press SHIFT and RUN together. Petspeed loads, asks for the name of the source program, and that is that. Line numbers scroll up the screen as each of the four compiler passes are made, and after a few minutes the translated program is on disk and in memory ready to RUN immediately. The first time I used Petspeed I felt a certain unreality about it all — can that really be all there is to it? In most cases the answer is 'Yes'.

Petspeed is very tolerant. Apart from incorrect Basic, which would normally produce SYNTAX ERRORs in any case, only four problems are likely to arise. Most importantly, Petspeed does not like dynamically dimensioned arrays — eg, DIM A(N). The reason is that space must be made available for all the variables in the first pass and therefore array dimensions must be available at this time. Petspeed is very obliging when meeting this particular error. Rather than just give an error message, the compiler invites the user to type in the appropriate dimension after which compilation continues. Unfortunately my copy of Petspeed does not do this. After inviting the input the program hangs up irretrievably. Oxford Computer Systems suggests that my CBM 4032 has particular ROMs which the current version of Petspeed does not like (one of the so-called 'fat 40' machines). I am assured that everything is okay on the 8000 series machines and that they are working on a solution for these particular 4000s. In the meantime the only solution is to switch off and start again — not very elegant.

Petspeed dislikes certain MID$ calls where the third argument is an array or function reference — for example, MID$(A$,5,LEN(A$)-2). This is easily changed to avoid the function reference. Petspeed itself makes use of page zero addresses and Basic programs which also do this could get into trouble. The final limitation is that without other assistance it is not possible for overlaid programs to share the same variables, although a utility program is available to cope with that.

A number of compiler error messages may be given. All, apart from 'UNDEF'D STATEMENT ERROR IN. . .', are fatal and result in the computer memory being cleared ready for the object program to be loaded for correction. Unfortunately, my copy again leaves the computer hung-up and a switch off is needed. The only other bug I found appeared at the end of compilation. Petspeed uses a narrow screen window to display the line numbers during compilation. At the end it clears the text window with ASCII 14. This is fine for an 8000 series machine but leaves a 4000 series machine with an expanded screen — not serious but definitely an irritation.

The small number of limitations means that very many Basic programs will be compiled without any modification at all. However, there are features of Petspeed which could make it desirable to rewrite programs. User defined string and mixed functions are allowed — eg, DEF FNA$(X$) — which are not permitted in CBM Basic; and secondly a special operator can be inserted into the program to enable Petspeed to recognise all characters of a name rather than just the first two.

Another pair of operators causes the STOP key to be enabled and disabled when required without resorting to PEEKs and POKEs. These features, and the fact that all the usual efficiency tricks (such as declaring variables in order of importance, putting speed-critical subroutines at the start of the program, no spaces in lines, no REMs, etc) are not needed, mean that a very much more readable program can be written. The main disadvantage is that if these facilities are used it may not be possible to debug the program in Basic before compilation.

It is important to realise that Petspeed is not a true compiler. The Basic program is not translated to machine code but to an intermediate, but faster, 'speedcode'. The speedcode is then interpreted at run time by a speedcode interpreter built into the translated program. This interpreter is about 8k long and so small Basic programs will become very much longer in translation. On the other hand, very long programs will be shortened; the break-even point being about 70k. Of course programs with many REMs, spaces and long variable names would tend to a greater reduction in size.

The first compiler pass finds all the variables and reserves space for them. DATA statements are found and whenever possible are converted into both ASCII and binary equivalents in order to save ASCII-to-binary conversion time when the compiled program is run. The next phase is a general syntax analysis and the construction of a parse tree which in pass 3 is simplified into blocks of speedcode. Finally, in pass 4, all the sections of speedcode are linked together and the finai code, with a copy of the interpreter, is saved on disk in a file with '.gt' appended to the filename.

Having examined Petspeed in general, how fast are the programs it compiles? The answer would seem to be that they are quicker, but not by much. My first trial was on a simple literature reference filing program. This involves relative file transfers to and from disk and screen display, a modicum of keyword searches within strings and hard-copy printout. As one might expect, the operations which depend on mechanical operation at some point (ie, disk and printer operations) were affected little — a factor of 1.5 to 3 depending upon the length of the data string transferred. This doesn't sound very much, but to the user it may be significant. A waiting period of, say, half a second for a file to be transferred from disk to screen is perceived as much more than twice the quarter of a second that might result after a Petspeed translation. Programs do indeed seem much faster even if the stopwatch gives the lie to it. Operations which involve only manipulations within the computer may be speeded up much more, although the one-liner FOR I=0 TO 1000:NEXT achieved only a factor of 4.8. Table 1 gives timings for a simple bubble sort program used to sort a random series of 256 strings or numbers before and after Petspeed translation. ('Before' refers to the original Basic program, 'After' to the 'Petspeed' translation.)

	Before	After	Ratio
Strings (avg 4.3 char)	650	86	7.5
Integer variables	652	64	10.1
Reals variables	635	82	7.8
Real variables-integers	630	69	9.2

Table 1 Bubble sort timings

It is surprising that the CBM Basic is slightly faster for a 'real' sort than for an integer sort. The Petspeed versions were much faster, of course, but nowhere near the claimed 40 times. Oxford Computer Systems emphasises that Petspeed, wherever possible, uses integer arithmetic, resorting to floating point only when necessary. This is probably the reason for the difference between the two sorts using real variables. The sorting was faster in the

PETSPEED

Petspeed version when only integer numbers were involved.

A better feeling for the scale of the improvement in speed might be given by looking at programs that are both simple and familiar, at least in name, such as the Benchmark programs beloved by microcomputer analysts. The timings, for a CBM 4032, were made using the internal clock and are slightly different to those given in *PCW* Nov 1982.

	Before	After	Ratio
BM1	1.33	0.267	5.0
BM2	9.02	0.683	13.2
BM3	17.2	5.92	2.9
BM4	18.9	6.77	2.8
BM5	20.8	6.9	3.0
BM6	35.4	8.77	4.0
BM7	56.8	11.2	5.1
BM8	11.2	4.92	2.3
BM2+	43.5	0.7	62

Table 2 Benchmark timings

The best improvement in speed (BM2) is for the case when the Benchmark program introduces a branch in the form of GOTO. In Petspeed the destination address is calculated once and for all during compilation and a direct branch is possible during execution. With this in mind I appended Benchmark 2 onto the end of a 20k Basic program at line 6100 and inserted line 1 GOTO 6100. The difference between the Basic and Petspeed versions is shown as BM2+ in Table 2. The Basic program is nearly five times slower while the Petspeed version is hardly affected. The speed ratio is now 62 — even better than the advertised claims.

Apart from the artificial case of BM2+, all the programs I have been able to test have been either small programs or well-written Basic routines in which all the tricks mentioned above have been incorporated to achieve maximum speed in Basic. It is not surprising, therefore, that the speed improvements have not been as great as the advertisement would lead us to expect.

A common complaint of reviewers is the quality of the documentation supplied with software. The Petspeed manual is, to say the least, slim. However, bearing in mind the simplicity of use and the few restrictions on use — all of which are covered fully — there is no reason to expect more. With the exception of the 'fat 40' bug all potential pitfalls are explained.

Conclusions

The good news about Petspeed is that it is easy to use, and allows better internal documentation and readability of the original Basic program by removing the penalties associated with the free use of REMs for internal documentation and logical program structure. As a bonus, the resulting translated program is unlistable. The consequences of the latter are that any software protection devices within the program cannot be stripped out — a factor which must be of at least passing interest to commercial software writers.

The bad news is that, unless you are an unusually verbose programmer, you are unlikely to speed your program by anything like a factor of 40. Having said that, in most situations the speed improvement is useful — a factor of 10 for an integer sort is not to be cast aside lightly — and has certainly made the programs I have compiled more pleasant to use. If a speed improvement of as much as 40 is important to you then Petspeed is probably not the answer. If you can't afford the £240 for Petspeed then you can go a long way to achieving the same objects by attention to the way in which you write your program. If you have a 'fat 40' computer and don't want the bugs it may be advisable to wait until an updated version is available.

Petspeed is available from Oxford Computer Systems (Software) Ltd, The Old Signal Box, Hensington Road, Woodstock, Oxford OX7 1JR, at a cost of £240 plus VAT.

PORTABLE COMPUTER WORLD

BEAT THE TAX TABLES

Retired taxman G W Duell explains how to use a Casio calculator for income tax calculation.

Using a Casio FX-502P calculator I set out to beat the Tax Tables but with little hope of success. Calculating a year's tax given the allowances is relatively simple — so much at 30 percent, so much at 40 and so on. However what I wanted to do was to produce a program which could be used by anyone involved in wages to avoid the chore of using tables.

As a retired Senior Collector of Taxes I knew that by dividing your allowances by 10 and ignoring any remainder you get your code number. An examination of the week 52 free pay table showed that multiplying the code number by 10 did not produce the correct figure of free pay. My first task was therefore to establish the relationship between the code number and the figures in the table. I subtracted each figure from the succeeding one and eventually spotted that there was a repetitive pattern in each set of 13. Within the 13 there was also a pattern over 7 and then over 6.

It took me a long time to solve the problem of how to get a method which would get the calculator to repeat these patterns but I finally cracked it. First add 10 to the code number and divide by 13 — the remainder will of course be a number between 0 and 12 (using a calculator the remainder will be the decimal equivalent of so many thirteenths). If the remainder is equal to or greater than 7 subtract 7 multiply by 0.4 add 9.2 then add the code number multiplied by 10. If the remainder is less than 7 multiply it by 0.4 and add 9 then add to 10 times the code number. Lo and behold — you now have the free pay for the year, so simply dividing by 52 and multiplying by the week number you have a complete set of free pay tables for the weekly paid. The ingenuity of the system is not very obvious but it ensures that every figure is exactly divisible by 52 — pounds and pence.

Only one code number does not fit — Code 0, so the program has to branch in three directions to take into consideration that in the event of the code being 0 the free pay is nil.

Once the free pay is calculated, subtracting it from the gross pay will give the taxable pay. We then round this figure up to

		Remarks	Steps
P0	Min 0 , 0 , HLT , Min 1 , 0 , HLT , Min 2 , Inv x= 0 , GOTO 1 , ÷ , 3 , = , INV FRAC , × , 3 , × , · , 2 , + , 9 , = , Min 3 , MR2 , × , 1 , 0 , = , M+ 3 , MR3 , × , MR1 , ÷ , MR5 , = , HLT , GOTO 3 ,	Calculate Free Pay	
LBL 1 ,	0 , Min 3 , HLT , GOTO 3 ,	Code 0	(41)
LBL 3 ,	From this point the program is virtually the same as that for weekly tables. Change all references MR4 to MR5 and omit subroutine P6. See text for Casio FX-602P modifications.		166
P7			7
P8			36
P9			6
		Steps left	37
		Programs	4
		Total	256

Program — monthly tax tables

		Remarks	Steps
P 0	Min 0 , 0 , · , 9 , Min F , 0 , HLT , Min 1. 0 , HLT , Inv x = 0 , GOTO 2 , Min 2 , + , 1 , 0 , = , ÷ , 1 , 3 , = , Inv Frac , × . 1 3 , = , Inv x >= F, GOTO 1 , X · , 4 , + , 9 , = , Min 3 , GSB P6 , HLT . GOTO 3 ,	Calculate and Display Free Pay	
LBL 1 1	− , 7 , = , × , · , 4 , + , 9 , · , 2 , = , Min 3 , GSB P6 , HLT , GOTO 3 ,		
LBL 2 ,	0 , Min 3 , HLT , GOTO 3 ,	Code 0 or BASIC RATE	
LBL 3 ,	M−0 , MR 0 , HLT , Inv Int , Min 0 , MR6 , GSB P7 , Min ·6 , MR0. Inv x >= F , GOTO 4 , × , · , 3 , = , GSB P8 ,	Taxable Pay Check Tax band Tax at 30% — Band 1	
LBL 4 ,	MR8 , GSB P7 , Min ·7 , MR0 , Inv x>= F , GOTO 5 , − , MR ·6 , = , × , · , 4 , + , (, MR ·6 , × , · , 3 ,) , = , GSB P8 ,	Tax band 2	
LBL 5 ,	MR ·0 , GSB P7 , Min ·6 , MR0 , Inv x>= F , GOTO 6 , − , MR ·7 , = , × , · , 4 , 5 , + , (, MR9 , × , MR1 , ÷ , MR4 ,) , = , GSB P8 ,	Band 3	
LBL 6 ,	MR ·2 , GSB P7 , Min · 7, MR0 , Inv x= F , GOTO 7 , − , MR ·6 , = , × , ·5 , + , (, MR ·1 , × , MR1 , × , MR1 , ÷ , MR4 ,) , = , GSB P8 ,	Band 4	
LBL 7 ,	MR ·4 , GSB P7 , Min ·6 , MR0 , Inv x>= F , GOTO 8 , − , MR ·7 , = , × , · , 5 , 5 , + , (, MR ·3 , × , MR1 , ÷ , MR4 ,) , = , GSB P8 ,	Band 5	
LBL 8 ,	MR0 , − , MR ·6 , = , × , · 6, + , (, MR ·5 , × , MR1 , ÷ , MR4 ,) , = , GSB P8 ,	Band 6	188
P6	MR2 , × , 1 , 0 , = , M + 3 , MR3 , ÷ , MR4 , × , MR 1, = ,	Part of Free Pay code	12
P7	÷ , MR4 , × , MR1 , = , GSB P9 , Min F ,	Part of Band Check	7
P8	Min 0 , · , 5 , Min F , MR0 , × , 1 , 0 , = , Min 1 , Inv FRAC , Inv>= F , GOTO 1 , + / − , M + 1 , MR1 , ÷ , 1 , 0 , = , HLT , GOTO 2 ,	Round to nearest 5p and end program	
LBL 1 ,	+ / − , + , · , 5 , = , M + 1 , MR1, ÷ , 1 , 0 , = , HLT , GOTO 2 ,		36
P9	+ , · , 9 , 9 , = , INV INT ,	Round up to whole no.	6
		Programs	5
		Steps left	2
		Total	256

Program — weekly tax tables

PAYE TABLES

Data	Memory No.	Contents	Memory No.	Contents
	4	52	5	12
Weekly & Monthly	6	11250	7	3375
	8	13250	9	4175
	10	16750	11	5750
	12	22250	13	8500
	14	27750	15	11525

a whole number and if it less than £11,250 ÷ 52 x *week number* it falls within the first taxable band. Multiplying by 0.3 will now give the total tax due to date. If the taxable pay is greater than £11,250 ÷ 52 x *week number* we have to test whether it is greater or less than the next tax band — ie, £13,250 ÷ 52 x *week number* — if less, the tax is £3375 ÷ 52 x *week number* plus tax at 40 percent on the amount by which the taxable pay exceeds £11,250 ÷ 52 x *week number*.

All that may sound very complicated but by now we have established a pattern which can be used for any number of tax bands provided the correct figures are used. Where do we get the figures? Look at Table 'C', week 52 — at the bottom of column 1 you will find 11,250 and 3375 at the bottom of column 3. Now look at the bottom of each section and you will see where the figures in my data table come from. In order to use the data for monthly tables as well, 52 and 12 were included — the rest of the data is exactly the same.

Calculating the free pay for monthly pay was a much easier proposition — the addition to 10 times the code number is either £9 or £9.20 or £9.40. Divide the code number by 3, multiply the remainder by 0.2, add 9 then add 10 times the code number; divide by 12 and multiply by the month number and you now have the free pay tables complete. The tax is calculated in exactly the same way as for weekly — substituting months for weeks.

Having developed the programs so far I then failed within the available memory to find a method to round the tax to correspond with the tables so I settled for rounding to the nearest five pence. At week 52 and month 12 the figures are correct in all bands. They are also correct throughout band 1. In the other bands the errors are pence only and are self-cancelling in succeeding weeks or months so can be ignored.

Once the program and data are loaded enter the gross pay, select Program 0 — this will zero the display and HLT will appear; enter the week number and press EXE, this will again zero the display and await the entry of the code number followed by EXE — the free pay will now be displayed. Press EXE again to display the taxable pay and once again to display the total tax to date. Pressing EXE again will produce the 'E' but after getting the tax you can start again for further calculations. As a matter of interest I found that band one took 1.3 seconds to calculate and band 6 took about 4.5 seconds. If you get any minus figures, ignore them — they simply mean that the free pay is greater than the gross pay and the tax is therefore nil — again within the available memory I was unable to cope with this contingency.

If the Chancellor of the Exchequer makes any changes at Budget time the free pay parts of the programs will remain as they are. If, however, he changes the bands and/or rates the data and the figures representing the rates within the programs will need to be amended in July. I think I have given a full enough description of the programs for the necessary changes to be made and I see no reason why these programs should not be in use many years from now — the system has been with us since 1944.

With the Casio FX-620P with double the memory the calculation of the free pay for weekly and monthly can be kept as separate programs, P0 and P1. Each should start by putting into memory 4 the appropriate figure 52 for weekly and 12 for monthly. Change the GOTO 3 instructions to GSB 3, then start the tax calculation sections in P3. By doing this so much memory will be saved that you can then use P5 to input the data into memories before you start and thus have a completely self-contained program. You may not be interested in all the tax bands — if not you may enter only as many as required. Retain the band checking procedure just in case you exceed the limits of the band.

Finally, please run and check the working of the program. It is a serious applications program and I should not like to be blamed by my former colleagues for messing up the tax system.

END

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.
PCW can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

GRAPHIC MEMORY

It is difficult to fault the BBC micro, but one criticism which is justifiably levelled against it is the shortage of RAM available when full use is made of the memory mapped graphics. This note describes the steps required to locate a program at a lower memory address than usual, effectively giving additional program/data space.

The technique is based on assigning an appropriate value to the variable PAGE before LOADing, CHAINing or typing in a program; for example:

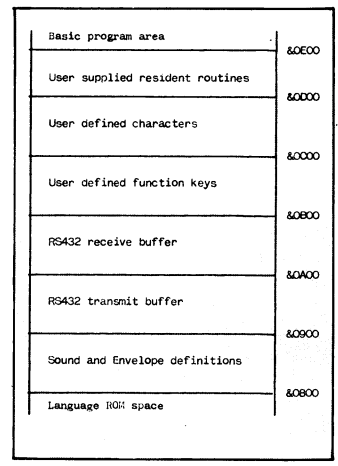
```
> PRINT PAGE 3584
:REM The default value is &E00 = decimal 3584.
> PAGE=3328 :REM The new value must be on a page boundary (3328 = &D00).
> NEW :REM This is only necessary if the program is to be typed in,
> LOAD "Long-prog"
:REM it is optional before a LOAD or CHAIN operation.
```

The new page boundary chosen depends on the facilities employed. In particular, pages &0C and &0D may be used if there are no user supplied routines or characters, page &0B if the programmable keys are not employed, pages &09 and &0A if the serial port is unused and lastly page &08 when the program is free of sound commands. Needless to say, the *lowest* value of PAGE is determined by the *highest* unused page, since the Basic program must be stored in contiguous locations. However, you can always store machine code subroutines below PAGE: for example, if you require special characters (page &0C) you could put machine code between &09 and &0C.

Fairly straightforward — but there is a catch. Typing "OLD" after pressing the BREAK key no longer restores a program, since PAGE is reset to its default value and two special characters are written to &0E00 and &0E01, corrupting any code in these locations. If you feel that you need this facility you will have to store the contents of &0E00 and &0E01 in an integer system variable, say G%. Thus, one of the first statements in the program would be G%=!&3584. Then, after pressing BREAK, the following sequence would restore the program:

```
> PAGE=3328 :REM Reset PAGE to the value chosen.
> OLD
>!3584=G% :REM Write the two corrupted bytes back to memory.
> END :REM Sort out the internal Basic pointers.
```

If desired, the BREAK key may be redefined to incorporate these statements:




```
>*KEY 10 PAGE=3328 :M OLD :M !3584=G% :M END :M
```

but then page &0B00 cannot be used for Basic and the maximum saving is only one third of the potential 1½ kbytes.

Steve Sanoff

FLASHY ALTERNATIVE

BBC micro users will be familiar with the use of P.CHR$136 as a precursor to flashing text in the teletext mode. P.CHR$137 is equally familiar as the way to return to a steady display later on the same line.

I have found that similar and more useful effects can be achieved after an *FX 4,1 call when the cursor-left key returns a 136 code and the cursor-right key returns a 137 code.

Thus (cursor-left)FLASH(cursor-right)STEADY has the same effect immediately, ie, as it is typed in, as does P.CHR$136"FLASH" CHR$137"STEADY" after pressing (return).

The technique can be used to insert flashing REMs or flahing printouts during programming:

```
10 REM"(cursor-left) A FLASHING REM
```

leaves the text of the REM flashing immediately, after listing, and even after saving and loading the program. Once in the program the effect persists after the *FX 4,0 call has been used to return the cursor control keys to their normal editing role. In fact a flashing program line can be copied using the (copy) key to reproduce the effect elsewhere.

```
20 PRINT"(cursor-left)FLASH(cursor-right)STEADY"
```

gives the expected result both when the program is listed and when it is run.

Note the use of a " after the REM in line 10. Without it the operating system interprets the byte containing the 136 code as STEP. (136 is the Basic token for the STEP instruction.) As a result STEP is printed instead of a space when the line is listed or loaded. In the same way, (cursor-right) will list as SPC if the " is omitted.

To assist in moving between flash and edit modes, I program two of the user definable keys with the *FX calls.

Calvin R Woodings

TJ's WORKSHOP

SPECTRUM PASCAL

Here is a set of short Pascal procedures that readers may find useful.

They are written specifically for a ZX Spectrum 48k running the (rather fine and fast) Hisoft Pascal compiler. Obviously this compiler does not provide any graphics support at all for programs. These procedures provide a reasonable selection of commands.

Circle does exactly what it says and its syntax is nearly that of the standard Spectrum circle command, except that it requires brackets. Disc draws a disc full of colour, though not terribly well — I should be interested to see whether any readers have any better ideas. Plot is as Spectrum plot (except for the brackets again). DRAWBY is a relative draw, as on the Spectrum, but LINE is absolute and is thus quite useful. It draws an ink line from (x1, y1) to (x2, y2). FILL is a rectangle fill, and COPY is the standard Sinclair screen dump routine.

The procedures all work by either calling a ROM routine and passing variables to it by POKEing them into the three spare system variable locations at 23681,23728 and 23729 with, when required, two bytes of the printer buffer being used to pass the signs as well, or by calling a previously defined procedure. The ORD is needed because the Hisoft POKE of an integer is a 2-byte POKE, and thus wastes space if the integers are confined to the range 0 to 255.ORD actually POKEs the ASCII value of the number into the location, using one byte only.

There is room for improvement with a couple of the routines, but they all work and are quite useful. The speed and structure of Hisoft Pascal are a great improvement on the standard Spectrum Basic.

Mark Twells

```
Run??
AF92   210 PROCEDURE CIRCLE(X,Y,R
:INTEGER);
AF95   220 BEGIN
AFAD   230 POKE(23681,ORD(R));
AFBC   240 POKE(23728,ORD(X));
AFCB   250 POKE(23729,ORD(Y));
AFDA   260 INLINE(#D9,#E5,#D9,#3A
,#B0,#5C,#CD,#28,#2D,#3A,#81,#5C
,#CD,#28,#2D,#3A,#81,#5C);
AFEC   270 INLINE(#CD,#28,#2D,#CD
,#2D,#23,#D9,#E1,#D9);
AFF5   280 END;
AFFF   290
AFFF   300
AFFF   310 PROCEDURE DISC(X,Y,R:I
NTEGER);
B002   320 VAR I:INTEGER;
B002   330 BEGIN
B01A   340 FOR I:=R DOWNTO 1 DO
B03F   350 CIRCLE(X,Y,I);
B063   360 END;
B06E   370
B06E   380
B06E   390 PROCEDURE PLOT(A,B:INT
EGER);
B071   400 BEGIN
B089   410 POKE(23728,ORD(A));
B098   420 POKE(23729,ORD(B));
B0A7   430 INLINE(#ED,#4B,#B0,#5C
,#CD,#E5,#22)
B0AE   440 END;
B0B8   450
B0B8   460 PROCEDURE DRAWBY(X,Y:I
NTEGER);
B0BB   470 BEGIN
B0D3   480 IF X<0 THEN POKE(23296
,ORD(#FF));
B0F6   490 IF X>=0 THEN POKE(2329
5,ORD(1));
B11B   500 IF Y<0 THEN POKE(23297
,ORD(#FF));
B13E   510 IF Y>=0 THEN POKE(2329
7,ORD(1));
B163   520 POKE(23728,ORD(ABS(X))
);
B175   530 POKE(23729,ORD(ABS(Y))
);
B187   540 INLINE(#D9,#E5,#D9,#ED
,#4B,#B0,#5C,#ED,#5B,#00,#5B,#CD
,#BA,#24,#D9,#E1,#D9);
B198   550 END;
B1A2   560
B1A2   570
B1A2   580 PROCEDURE LINE(X1,Y1,X
2,Y2:INTEGER);
B1A5   590 BEGIN
B1BD   600 POKE(23677,ORD(X1));
B1CC   610 POKE(23678,ORD(Y1));
B1DB   620 DRAWBY(X2-X1,Y2-Y1);
B210   630 END;
B21A   640
B21A   650
B21A   660 PROCEDURE FILL(X1,Y1,X
2,Y2,INK:INTEGER);
B21D   670 VAR I:INTEGER;
B21D   680 BEGIN
B235   690 WRITELN(CHR(16),CHR(IN
K));
B249   700 FOR I:=X1 TO X2 DO
B276   710 BEGIN
B279   720 PLOT(I,Y1);
B290   730 DRAWBY(0,Y2-Y1);
B2B3   740 END;
B2B7   750 END;
B2C2   760
B2C2   770
B2C2   780 PROCEDURE COPY;
B2C5   790 BEGIN
B2DD   800 USER(#0EAC);
B2E3   810 END;
```

ACE VOCAB SELECT

Users of the Jupiter Ace will find that when using VLIST their latest words rapidly scroll off the top of the screen to make room for the standard Forth vocabulary.

The following word, LISTV, lists only the user defined words after clearing the screen, ending with the latest:

LISTV occupies 84 bytes (82 if CLS omitted), not including comments. I find it invaluable, using it frequently with REDEFINE and FORGET to edit the vocabulary.

John M Dixon

```
: LISTV
  CLS HERE 15440          (limits of user vocab.)
  DO
    I C@ DUP 127 AND      (fetch char. and strip
                           inverse bit)
    EMIT 127 >            (print, check if inverse, ie
                           last char.)
    IF
      SPACE I 1+ @ DUP    (fetch length field)
      0=
      IF
        LEAVE             (if 0 last word has been
                           listed)
      THEN
      1+                  (add to length to increment
                           loop index)
    ELSE
      1                   (increment index to next
                           char in name)
    THEN
  +LOOP
```

TJ's WORKSHOP

STATUS SYMBOLS

In the PC 1500 handbook STATUS 0 and STATUS 1 are explained — as program space remaining and program space used, respectively. No mention is made of STATUS 2, STATUS 3 and STATUS 4. The use of these is *essential* when programs involving PEEK and POKE are to be portable. The reason is that program space normally starts at 16581, whereas with the extra 8k memory program space starts at 14533.

STATUS 2 gives the first address after the beginning of program space. Thus, with no program in memory (and 8k attachment), STATUS 2 will give 14534. With program in memory, STATUS 2 — STATUS 1 will give 14533. Reference to (STATUS 2 — STATUS 1) rather than to a particular address will ensure portability of PEEK and POKE whether 8k attachment is present or not.

STATUS 3 gives the address after the end of program space. With 8k attachment this is not 22528, but 24576. This has one important use. When you write a program which DIMensions variables, STATUS 0 takes no account of this, and can return as available space a quantity which is not in fact fully available; and as soon as you run your program you may get ERROR 10. However, if you run the part of your program that does the DIMensioning, and then in RUN mode write (STATUS 3 — STATUS 2), the screen will display the *true* space available, since STATUS 3 moves to the front of space reserved for DIMensioned variables.

STATUS 4 contains the line number of the last line executed. This can be useful with errors, in conjunction with ON ERROR GOTO. However, if the error occurs in a multi-statement line, and a statement of the line has been executed before the error occurs, then STATUS 4 will give the actual line number, as if it had all been executed.

Ronald Cohen

VIC PIANO

Typing in long programs from magazines can be a rather dreary business even though the VIC has a very nice keyboard. So here is a short program to solve that problem and make typing a joy.

When this program is run the READY sign should appear after a pause of about two seconds. Now try pressing a few keys. Yes, the VIC is now a piano and the good thing is the program itself does not use up any of the 3.5k for your own programs.

If you want to stop this program for any reason then just press STOP+RESTORE, and to re-run type SYS672.

This program shows you that even a tiny machine code program can do things that Basic programs can never do.

Shingo Sugiura

```
 10REM  ********************
 20REM  *** VIC  MELODY ***
 30REM  **** KEY BOARD ****
 40REM  *BY SHINGO SUGIURA*
 50REM  ** (C) 1983  JAN.**
 60REM  ********************
 70
 80FOR I=0 TO 44
 90READ A:POKE 672+I,A
100NEXT I
110SYS 672:NEW
120
130DATA 120,169,176,141,20,3,169,2,141,21,3,88,96,0,0,0
140DATA 165,197,201,64,240,12,9,192,141,12,144,169,15,141,14,144
150DATA 208,8,173,14,144,240,3,206,14,144,76,191,234
```

PET/WALTERS INTERFACE

PCW reviewed the Walters WM 2000 printer in December. This program allows PET owners to list their programs on a WM 2000. Normally, this machine does not print the cursor control characters seen in most PET listings. This program prints lower case letters instead of the cursor control characters. A key is printed at the start of each listing.

Mark Callaway

PET LISTING

```
h= HOME
c= CLR
d= CRSR DOWN
u= CRSR UP
r= CRSR RIGHT
l= CRSR LEFT
v= RVS ON
f= RVS OFF


 1 R$=CHR$(13)+CHR$(27)+CHR$(15)
 5 OPEN2,4
 7 GOTO1000
 10 OPEN1,8,3,"PROG,SEQ,R"
 20 GET#1,A$:A=ASC(A$)
 30 IFA=19THENPRINT#2,CHR$(104);
 40 IFA=147THENPRINT#2,CHR$(99);
 50 IFA=17THENPRINT#2,CHR$(100);
 60 IFA=145THENPRINT#2,CHR$(117);
 70 IFA=29THENPRINT#2,CHR$(114);
 80 IFA=157THENPRINT#2,CHR$(108);
 85 IFA=18THENPRINT#2,CHR$(118);
 86 IFA=146THENPRINT#2,CHR$(102);
 90 IFA=35THENPRINT#2,CHR$(27);"B";:GOTO20
 98 PRINT#2,CHR$(27);CHR$(15);
 100 PRINT#2,A$;:GOTO20
 1000 REM
 1005 PRINT#2,R$;
 1020 PRINT#2,"PET LISTING";R$;
 1030 PRINT#2,"------------";R$;
 1040 PRINT#2,CHR$(104);"= HOME";R$;
 1050 PRINT#2,CHR$(99);"= CLR";R$;
 1060 PRINT#2,CHR$(100);"= CRSR DOWN";R$;
 1070 PRINT#2,CHR$(117);"= CRSR UP";R$;
 1080 PRINT#2,CHR$(114);"= CRSR RIGHT";R$;
 1090 PRINT#2,CHR$(108);"= CRSR LEFT";R$;
 1100 PRINT#2,CHR$(118);"= RVS ON";R$;
 1110 PRINT#2,CHR$(102);"= RVS OFF";R$;
 1120 DATA27,98,20,0,20,107,20,0,20,107,20,0,20,255
 1130 READA:IFA=255THEN10
 1140 PRINT#2,CHR$(A);:GOTO1130
 2000 REM*********************************
 2010 REM***                           ***
 2020 REM*** PET TO WALTERS 2000       ***
 2030 REM***       INTERFACE           ***
 2040 REM***                           ***
 2041 REM*** BY MARK CALLAWAY          ***
 2045 REM***                           ***
 2050 REM*** LISTS AN ASCII FILE       ***
 2060 REM*** CALLED PROG FROM DRIVE    ***
 2070 REM*** ZERO. PREPARE FILE BY     ***
 2080 REM*** LOADING YOUR PROGRAM      ***
 2090 REM*** OPEN1,8,3,"0:PROG,SEQ,W" ***
 2100 REM*** CMD1:LIST:PRINT#1:CLOSE1  ***
 2110 REM*** THEN RUN THIS PROGRAM     ***
 2115 REM*** SET SWITCHES A3,B6,B4     ***
 2116 REM*** AND B1 TO ON.             ***
 2120 REM***                           ***
 2121 REM*** IF YOU HAVE A 30NN THEN   ***
 2122 REM*** SET SWITCH B1 OFF AND     ***
 2123 REM*** CHANGE 1 R$=CHR$(13)+     ***
 2124 REM*** CHR$(10)+CHR$(27)+CHR$(15)**
 2125 REM***                           ***
 2130 REM*********************************
READY.
```

SHARP KEYWORDS

Users of the Sharp MZ-80K should be interested in the following short program. It prints each Basic keyword, followed by its corresponding token. 5336 and 5651 are the start and end addresses, respectively, of the keywords in Sharp Basic.

```
100 PRINT"Keywords and
    their tokens"
110 S=5336:E=5651
120 T=128
130 FOR I= TO E
140 Z=PEEK (I)
150 IF Z=255 THEN 190
160 IF Z>127 THEN 180
170 PRINT CHR$(Z);:GOTO
    200
180 PRINT CHR$(Z-128);T,
190 T=T+1
200 NEXT I
210 END
```

Alan Stevens

TJ's WORKSHOP

STEPPING STONES

The methods available to step through a long program on the BBC Computer are somewhat inelegant and difficult. The program presented here attempts to provide a nice solution.

The program should be loaded and run when the computer is first switched on. It will initialise soft keys 0 to 5 with the following functions: Key0 will run a program. Key1 switches to MODE7 and lists lines Q% to Q%+100 of the program (ie, the number of the starting line of the listing in the program is held by the integer variable Q%). Keys 2,3,4 and 5 clear the screen and increment and decrement Q% by 100 and 500 respectively.

To step through a long program, all that is necessary is to alternately press keys 1 and 2, and the program will appear in groups of a hundred lines, at the top of the screen. Keys 3, 4 and 5 allow more rapid movement and stepping backward.

This program works by poking the line numbers to be listed into the soft key buffer; because of this it must be typed into the computer exactly as shown. In order to aid doing this, spaces are shown as small b's; they must of course be typed as spaces.

D J Pilling

```
10 *KEY0RUN |! M
20 *KEY1$2895="bbbbbbbbb":$2895=STR$Q%+","+
   STR$(Q%+100)|!.MMO.7|! MLIST0000,0000|! M
30 *KEY2Q%=Q%+100|! MCLS|! M
40 *KEY3Q%=Q%-100|! MCLS|! M
50 *KEY4Q%=Q%+500|! MCLS|!M
60 *KEY5Q%=Q%-500|! MCLS|! M
```

MBASIC SORT

I was recently watching one of the clerks in my office sorting some dockets into numerical order when I realised that the method she was using could be used for a sorting routine in a program. The first docket was selected, then the second which was filed in relation to the first, then the third in order to the first and second, the fourth to the other three and so on. The program listed uses this principle by selecting a variable from an array and placing this in a new array in order relative to those already there. I have found that this routine works very well — so much so that 100 random numbers are sorted into ascending order in 30 seconds, whereas a bubble sort routine takes 60 seconds or more.

The program is written using MBasic. If the SWAP command is not available then line 1030 will need to be modified to carry out the swap. With MBasic this routine could also be used to sort strings. There is one advantage to this program; if anything does go wrong the original is still intact!

R W Bishop

```
10 DIM OLD(N),SORTED(N)
20      REM Where N is number of records
30      REM OLD is the file to be sorted
40      REM SORTED is the new file in sorted order
100 SORTED(1) = OLD(1)
105     REM First record in new array
110 FOR A = 2 TO N
120 SORTED(A) = OLD(A)
125     REM Read old array one at a time and place at the
            bottom of the new array
140 IF SORTED(A) >= SORTED(A-1) THEN GOTO 160
145     REM Check if larger than last item in new array
            If so then fetch next
            If not then Sub-routine to find position in new array
150 GOSUB 1000
160 NEXT A
170 END
180     REM Print routine can be inserted at 170
1000    REM Find position in new array
1010 FOR B = A TO 2 STEP -1
1020 IF SORTED(B) > SORTED (B-1) THEN RETURN
1030 SWAP SORTED(B),SORTED(B-1)
1040 NEXT B
1050 RETURN
```

SPEEDIER SARGON

Given time, Sargon can play good chess; but it is just too slow to use the higher ply levels. This improvement will speed it up by typically 25 percent, ie, over one minute on ply 3. I have found that it spends most of its time in ATTACK and the subsequent call to PATH, so by integrating PATH into ATTACK and making other improvements in the locality, a large time saving was possible. The revised version between ATTACK: and AT14B: is shown here. Further minor savings may be made in other parts of ATTACK (eg, by integrating with ATKSAV and PNCK), but additional major improvements can only be made by changing the algorithm of ATTACK.

Michael Jones

```
ATTACK: PUSH    BC              ;save BC
        LD      B,16            ;initial direction count
        LD      IY,TBASE        ;load index
AT5:    LD      C,(IY+DIRECT)   ;get direction
        LD      D,1             ;init scan count/flags
        LD      A,(M3)          ;board start position
        LD      HL,M2           ;prepare for skip
        JP      SKIP            ;skip AT10
AT10:   INC     D               ;increment scan count
        LD      HL,M2           ;get previous position
        LD      A,(HL)
SKIP:   ADD     A,C             ;add direction constant
        LD      (HL),A          ;save new position
        SUB     -BOARD          ;get position address
        LD      L,A             ;low byte
M2H:    EQU     M2/256
        LD      A,TBASE/256+M2H ;get high byte
        SBC     A,H
        LD      H,A             ;form pointer
        LD      A,(HL)          ;get contents
        INC     A               ;in border area ?
        JR      Z,AT12          ;Yes-jump to AT12
        DEC     A               ;not border-decrement
        LD      (P2),A          ;save piece
        AND     7               ;clear flags
        LD      (T2),A          ;save piece type
        JP      Z,EMTPOS        ;empty ?-Yes,jump
        LD      A,(P1)          ;get moving piece
        XOR     (HL)            ;same colour ?
        JP      P,AT14B         ;Yes-jump to AT14B
        BIT     6,D             ;(AT14A) same already ?
        JR      NZ,AT12         ;Yes-jump
        SET     5,D             ;set opposite found flag
        JP      AT14            ;skip to AT14B
EMTPOS: LD      A,B             ;get direction count
        CP      9               ;knight scan ?
        JP      NC,AT10         ;No-jump
AT12:   INC     IY              ;inc direction index
        DJNZ    AT5             ;repeat if not done
        XOR     A               ;no attackers
AT13:   POP     BC              ;restore BC
        RET                     ;return
AT14B:  BIT     5,D             ;opposite already found?
```

TRS-80 RENUMBER

Here is a short machine code subroutine to clean up the line numbers in a TRS-80 Basic program. It does not, unfortunately, affect GOTOs and GOSUBs. Maybe a reader could add this to the program. The machine code is loaded by Basic. The machine code itself is relocatable, and this could be done by changing line 100.

First turn off the machine, turn it back on, and reply to "MEM SIZE?" with 31999.

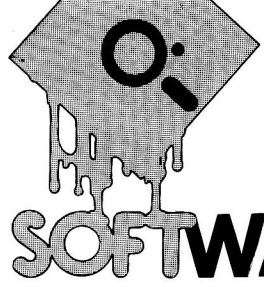
Next type in the following Basic:

```
100 POKE 16526,0:
 POKE 16527,125:
 X=32000
200 DATA 221,33,233,
 66,33,100,0,1,100,0,
 221,94,0,221,86,1,122,
 179,200,221,117,2,221,
 116,3,9,213,221,225,24,
 235,999
300 READ A: IF A=999
 THEN END
400 POKE X,A: X=X+1:
 GOTO 300
```

and then RUN the program.

To renumber a program, CLOAD it or type it in, and then use A=USR(0). The machine code renumbers the Basic program starting at 100 with increments of 100. This could be changed by POKEing 32005 with the start number (up to 255), and 32008 with the increment (up to 255). The GOTOS and GOSUBS will have to be changed manually.

Darrell Francis



SOFTWARE

WHICH SPREADSHEET?

MULTIPLAN

Mike Liardet looks at Multiplan — Microsoft's entry to the spreadsheet fray.

After releasing the Apple version of Visicalc about three years ago, Visicorp enjoyed at least 18 months completely unchallenged in the market for what has now become known as spreadsheet software. But in the last year and a half there has been a steady stream of Visicalc rivals arriving on the scene and, naturally, some of the established companies have been getting involved in this growth area.

Probably the best known of all the microsoftware companies, Microsoft's pedigree goes right back to those prehistoric days of 'core-store', paper-tape and teletypes — 1975 in fact, when the first of a million microcomputer systems was equipped with a Microsoft Basic interpreter. Now Microsoft has augmented its own spreadsheet system: Multiplan. Will Multiplan further enhance Microsoft's reputation for excellence? Will it be another Ford Edsel? (You should get this point if you have heard of a Ford Edsel and you definitely will if you haven't!)

The first thing that strikes you when confronted with a copy of Multiplan is the packaging: Microsoft has obviously invested a lot of effort (and money as well, I am sure) in presenting its 'new baby' to maximum advantage. A heavy-duty transparent plastic case holds a substantial ring-bound manual, system disks, various leaflets and a few pieces of carefully positioned cardboard mouldings — simply there to mask out awkward gaps and present an uncluttered appearance through the transparent box. Readers who are concerned by such a flagrant wastage of the world's resources on a mere piece of marketing-hype will doubtless be relieved to learn that you need not throw the box away after purchase — it readily converts into a sweet little bookstand to support your manual!

Anyway, underneath the packaging we eventually find the disks — my review copy was for the Apple II (DOS 3.3), but Multiplan is also available for The Apple III, CP/M systems and, of course, Microsoft's MS-DOS. All versions are evidently functionally identical, with just a few pages at the start of the manual outlining any minor differences, so non-Apple owners should still bear with me! (I also had the opportunity to take a quick look at the MS-DOS version on a Sirius, so have made occasional references to this, too. In particular, I have included benchmark results for the Sirius version, specifically to check out Multiplan's performance with a new generation (8088) processor and all that extra memory capacity.)

Getting started

Getting started proved fairly easy — the 'First Time' instructions were not on page 1, where I like to see them, but a little bit of page-thumbing soon tracked them down. A bit of disk copying, data disk initialisation, and two or three minutes later I was faced with a reassuringly familiar display of a spreadsheet. The only hold-up in all this was to have a good chuckle at the latest piece of computer jargon, encountered in the instructions for seeking the system for optional (on the Apple) 80-column display mode: 'Recable' — to exchange 40-column video cable connection with 80-column!

The initial display is of the top left hand corner of the spreadsheet, showing seven spreadsheet columns and 20 rows, all completely blank. The remainder of the display is devoted to helpful prompts: the names of twenty different 'commands', a 'what to do now' message and status information, such as percentage of storage space remaining, current cursor position, etc. Both rows and columns are identified by numbers, unlike many systems which use the alphabet for column headings. The repercussions of this are fairly great, since whereas 'Q99' is unambiguously a reference to a specified cell, '1799' clearly is not. Multiplan provides several alternatives for identifying cells, but the simplest is that they be written as 'RyCx' — eg, 'R17C99' — a little bit longer than 'Q99'!

Moving around

Moving the cursor around the spreadsheet is very simple — single control-key hits (ie, simultaneously pressing 'Control' and one other key) move the cursor left, right, up and down, with the VDU screen window being 'pulled along' by the cursor if an attempt is made to move to a cell off the edge of the screen. Sensibly, the keys that achieve this movement are arranged in a diamond (on the Sirius the arrow keys are used) — easy to remember and easy to touch-type when you are looking at the screen. Further investigation reveals that there are also control-key hits to 'home' the cursor to the top left hand cell and to the bottom-right, and a 'Go-to' command where destination coordinates can be typed in, as well as a rapid scrolling facility where the cursor is moved several cells at one go.

Also of particular interest is a very powerful split-screen facility. The screen can be subdivided into display areas (called 'windows' in the manual), each displaying different parts of the spreadsheet, and the cursor can be quickly 'jumped' from one to the next. There are many possible uses for this: locking row and column headings for continual display, quick movement between different parts of the spreadsheet, and keeping totals or whatever continually in view when other parts of the spreadsheet are being modified. Moreover each window can be displayed with a nice surrounding border, and can also be 'linked' to another window so that columns or rows in both always line up correctly. If all this sounds a little confusing to the newcomer, then take heart. You can completely ignore the facility at first, but once you are ready for it, the chances are that however you want to lay-out your display then Multiplan will accommodate you.

Entering data

As with most spreadsheet systems, the 'bread and butter' activity centres on entering or changing numvers, titles and formulae. To achieve this, simply move the cursor to the cell to be changed and start typing whatever is required there. The only thing to watch out for is that text entry must be preceded by selecting 'Alpha' mode (simply press 'A' before typing the text) otherwise the chances are Multiplan will assume you are entering a command — occasionally disastrous. For example, a sensible abbreviation for Total-Costs-Yacht could be 'TCY'. Enter this without pressing 'A' and Multiplan does a 'Transfer-Clear-Yes', wiping out the entire spreadsheet! Don't believe it could happen? A *PCW* editor (I'll spare his blushes) did it! Well, it probably wasn't a yacht, but a yo-yo or a yard-of-ale or something. . .

The formulae themselves can be built up using a wide range of maths and other functions, including trig, standard deviation, string concatenation, logical and table look-up, etc. The notation used is the

classic keyboard version of school maths notation, easily learned by anyone not already familiar with it. As we have already mentioned, formula references to cells require an 'RyCx' notation — eg, the formula to add the first 2 cells on the first row could be written as 'R1C1 + R1C2'. However, there is a little trap lurking for experienced spreadsheet users — the replication facility does no formula adjustment whatsoever. Thus, if the above formula was located at R1C3, and then copied to 99 cells below, each and every copy would be 'R1C1 + R1C2', and the expected Column3 = Column1 + Column2 would not be achieved. It turns out that the original formula, quite correct if no replication is envisaged, should be 'RC[-2] + RC[-1]', meaning 'add cell in current row two columns back, to one in current row one column back'. Now, wherever this formula is located, it will add together the two previous values on the row, and in particular, if replicated right down column 3 it will do the column sum correctly.

If typing 'RC[-2] + RC[-1]' seems like a bit of a fingerful (tactile equivalent of mouthful) then Multiplan to the rescue! Instead of working out 'RC[-2]', etc, simply use cursor moves in mid-formula entry and Multiplan will type in the formula for you. In the above example only the '+' need be entered from the keyboard, the rest of the formula being built up by using the cursor to point to the cells to be referenced.

It is also possible to refer to cells by their row or column name and thus build up formulae like 'profit = sales – costs'. Since (a) this is immediately comprehensible and (b) always replicates correctly, the extra typing involved is well worth it!

In conclusion, I must say that I did not greatly like Multiplan's methodology for referencing cells. It should be noted that cell references occur not only in formulae, but are also required by the majority of commands (see below), so a major part of one's time at the keyboard is spent using them. In fairness I must point out that (a) my previous spreadsheet has been with the Visicalc style of cell-reference and (b) that Multiplan has some compensations for this minor irritation with some excellent other features and facilities.

Commands

Thus far, we have looked at Multiplan's basic essential facilities, but of course there are many other, typically more peripheral (in both senses!), functions needed to provide a comprehensive spreadsheet system. These extra functions are provided for by Multiplan commands, and invoked by selection from a command-menu.

Actually, in passing, we have already touched upon four commands provided by Multiplan — 'Go-to' cell, 'Alpha' for entering text, 'Copy' for replicating cells, and 'Window' for the split-screen facility. There are in fact 20 in all, each starting with a different letter of the alphabet, and all permanently displayed at the bottom of the screen. Bearing in mind that there were only six letters of the alphabet to spare, the implementors have done a pretty good job of choosing 20 sensible names — probably the worst one is 'Alpha' (it couldn't be 'Text' because that clashes with 'Transfer' and 'Transfer' couldn't be 'File', 'Storage' or 'Disk' because F, S and D are in use, etc).

Anyway, in the unlikely event that a command's meaning is unknown, or in the more probable event that the precise method of usage is unclear, there is an excellent 'Help' facility available. Basically the list of command names has its own cursor, which can be shifted along by pushing the space bar. Commands can be selected by moving the command-cursor then pushing 'Return' (or by just typing the command's first letter — much quicker). However, if '?' is hit instead of 'Return' the spreadsheet screen is replaced with a 'help' screen for the currently indicated command. Moreover the information is not just a few cryptic instructions, but a fairly comprehensive run-down which in some instances extends to several pages. By the way, all the help-screen information is read from disk when needed, and does not affect the precious memory allocation for the spreadsheet itself.

To get some idea of the command facilities available, here is a quick run-down of all 20:

* Alpha. Enables text to be entered at the current cursor position.
* Blank. Blanks out one or more cells. Contents are blanked out, but display format assigned to cell is unchanged. Not the same as Delete since, in particular, the following rows or columns are not shifted.
* Copy. Copies cells from one place to another (ie, replication). Relative-copy is not possible (see text above) — must do absolute copy of relative formula!
* Delete. Deletes a row or column of cells, moving all subsequent rows/columns back by one.
* Edit. Instead of correcting a long formula by retyping from scratch, this command can be used to apply the changes quickly.
* Format. Numerous different display formats are possible: different column widths, centre, left, right justify, scientific, integer, financial, primitive bar graph, and more besides! As an extra convenience, a default format can be specified, assigning the format you most expect to use to all cells not explicitly reformatted to something else.
* Goto. Go to cell specified by its name or coordinates.
* Help. Gives general help information, not covered by the help-screens, for each specific command.
* Insert. Inserts a blank row or column, moving all subsequent rows/columns along by one.
* Lock. Locks or unlocks specified cells. Can permanently lock all formulae — useful for turnkey systems.
* Move. Moves a row or column to between two other row/columns.
* Name. Enables a cell or group of cells to be given a user-supplied name. This name can be used in formulae, and also by the 'Goto' command. It saves confusion if the name here is the same as the visible title. It saves confusion if the name here is the same as the visible title.
* Options. Used to set basic operational features, eg, switch off auto-recalculation or audible error beeps. The former is very useful when the spreadsheet is getting fairly full and every change takes several seconds — not to be registered on the screen, but for its effects to permeate through the system. The latter is absolutely priceless if you work at home and your family 'can't stand that incessant cheeping' (to quote my good lady).
* Print. Can print to printer or disk file. Option to print the formulae as well as the calculated values. This is useful for docu-

Checklist

Documentation: 400+ pages, contents, tutorial, reference, index, quick reference and help-screens. Well-illustrated. Excellent.
User-friendliness: Consistent and easy to use — cell-referencing can be a little tricky!
Error-handling: 20+ error messages. Erroneous calculations (eg, zero-divides) displayed as special error values.
Facilities:
Arithmetic and other functions: +, −, *, /, %, string operations, logic, descriptive statistics, trig, logs, look-up and more besides!
Configuration: version tested easily configured for different types of Apple screen.
Graphics: a let-down compared with the other facilities!
Interface to other software: specifically can read Visicalc files, and print to disk. Can also be interfaced to other software using data interchange format (requires programming skills to do this).
Spreadsheet overlays: yes — can do consolidation or merge information into existing spreadsheet.
Turnkey: Apple version is turnkey with all disk formatting, copying, etc, achievable without recourse to Apple DOS.
Insertion, deletion and replication: yes.
Display flexibility: just about everything you could possibly want. Excellent.
Protected cells: yes.
Formula printout: yes.
Formula editing: yes.
Automatic/manual recalculation: yes.
Out of memory: memory left permanently displayed. Recovers correctly when it runs out of memory.
Long jumps: can jump directly to any specified cell.
Sorts, searching and logic: yes.

menting or debugging the model. It's also possible to print selected areas.
* Quit. Finish — back to resident operating system (eg, CP/M, MS-DOS, etc).
* Sort. Sorts calculated or entered numbers or text by suitably shuffling rows.
* Transfer. Load, save, delete and other disk file operations. Of particular note: Multiplan can read Visicalc data files, or read/write files in a well-documented external interchange format, as well as using its own internal disk format. As it can also print to disk, it is extremely versatile in its file-handling.
* Value. Can optionally be used for entering formulae or numbers.
* Window. Split screen facility.
* eXternal. Used to read in answers calcuated by one spreadsheet as raw input data for another. Can be used for 'consolidation'.

Documentation

The documentation is comprehensive, clear and well-written. The bulk of it is in a stout ring-bound manual (minor niggle — the rings are not circular and tend to snag the pages when you are turning them quickly). It has obviously been put together with the sort of thoroughness we would expect from Microsoft, right from the Contents page at the front to the Index at the back. The basic material provided is:
* System-specific instructions. How to create your working disks under your particular operating system.
* Tutorial. Organised as seven lessons. Gives you key by key instructions, starting with simple cursor moves in lesson one through to multiple work-sheets at the end. Well illustrated.
* Reference. In alphabetical order, everything you need to know about the command, key-strokes and formula-functions. Also includes a list of all system messages, together with advice on what to do when you encounter them.
* Appendices. Extra helpful information, including a glossary and notes for Visicalc experts — a nice touch!
* Quick Reference Guide. A separate pocket book (16 pages), being a condensation of the reference section in the main manual.
* Help Screens. Comprehensive instructions on-screen for every command and a few of the other facilities.

With this breadth of documentation, there should be something to please all levels of user. Complete beginners can try the tutorial. Experts will probably just use the quick reference guide or help-screens and everyone can make good use of the comprehensive index.

Sirius slip-up

Having given the Apple version a thorough work-over, I arranged a joyride on somebody else's Sirius. The article was nearly complete — I just needed to pencil in the Sirius Benchmark times and then off to Mustique for yet another three weeks.

First problem: Sirius version of Multiplan manual temporarily mislaid. Well, I should know the system well enough by now. So, in preparation for Benchmark 1, I quickly set up the first 12 columns by 200 rows of the spreadsheet. (Readers familiar with the benchtests will know that this results in a display of 1. .12 in the first row, 13. .24 in the second, etc.)

Next I needed to set up column 13, each cell in it being the sum of the previous 12 in the row. Easy! Just use the row-sum function in column 13 of row 1, and then copy it down to all cells below it. Unfortunately I couldn't remember the correct syntax for using it. Anyway, after experimentation I found that 'SUM(C1:C12)' at least did not give a formula error message, but it did seem to be displaying the wrong answer. Okay — time to copy it. Well, much disk-whirring and clanking, then watch the calculation count-down on the VDU display. 45 minutes later; I'm still waiting and the disk is still whirring and clanking and countdown's still not finished — I'm frightened to switch off in case I corrupt the disk (it's not mine, anyway) — can't stop it at the keyboard, etc. Anyway it took about 50 frustrating minutes.

So, what went wrong? Well, basically a minor slip-up in my use of the SUM formula. I eventually got it right (by using a help-screen, what else?): 'SUM(RC[-12]:RC[-1]', and the whole test was over in under a minute. The formula I had originally used did not add the row up, but calculated the whole 12x200 array of numbers, and of course this formula was then copied 200 times down the column — a bit of a hefty number-crunch!

Anyway, the moral of this story is: make a good effort to learn Multiplan's cell-referencing — it could save you a long wait!

Conclusion

We have taken a fairly fast swoop right through the major facilities and features of Multiplan; so fast that some very valuable features, not generally available in mere state-of-the-art spreadsheet systems, may have gone unnoticed. Just for the record, Multiplan gives you:
* Sorting. If you need to sort columns of figures or text then it is impossible to do this without a 'Sort' command.
* Multiple worksheets. Results from one worksheet can be communicated to another, useful for consolidation.
* Multiple split-screens. Very flexible facility to design VDU screen display of spreadsheet.
* Flexible file handling. In particular data interchange with other software is feasible, and Visicalc data files can be read (but not written! — no doubt Microsoft doesn't want to encourage users to migrate that way!).
* Available on 16-bit microprocessor (8088/6). The new 16-bit processors can handle a lot more memory, and spreadsheet systems which have been properly installed on them can use this extra memory for setting up bigger spreadsheets (see Benchmarks).
* Comprehensive help-screens. In addition to these, Multiplan also provides more mundane, but by no means universally available, facilities — such as cell references by names, formula protection, formula printout, print to disk and formula editing.

Certainly Multiplan has a lot of facilities to offer, but what is it like to use? Well some minor complaints here: the row/column numbering scheme increases the amount of typing for formulae. You have to consider replication consequences when you enter a formula, rather than when you do the replication. you have to choose the 'Alpha' command before you enter text (okay, it's only one extra character, but most other spreadsheet systems don't do it this way). To balance these minor grumbles are comprehensive error messages, and understandable prompts for all input.

So finally, my advice to spreadsheetless owners of Apples, CP/M or MS-DOS systems, or to anyone looking for an upgrade: put it near the top of your list!

Benchmarks and other measurements

These tests were run on an Apple II system with 64k of RAM (which is in fact mandatory) and an 80-column display card (which is optional). Available space for the spreadsheet itself amounted to 21k. Figures are also included for the Sirius (with 128k of RAM, and theoretically extendable to 800k+), running MS-DOS and allowing greater storage space for the spreadsheet. Where the Sirius figures are different they are appended in parentheses after the Apple figures.

Incidentally, a Sirius retails for around £2500, and the nearest equivalent Apple system (but with lower disk capacity, half the RAM, 8-bit processor) would be around £1750.

Spreadsheet size: 63 columns wide by 255 rows.
Numeric precision: 14 digits.
Max column width: 32 characters.

The benchmark tests are described in 'Which Spreadsheet', *PCW* Feb 1983.
Benchmark 1: (a) max rows accommodated: 95(235); (b) recalculation time: 60(55) seconds — ie, 1.5(4) rows per second: (c) recalculation time: 60(55) seconds; (d) vertical scrolling: 6(6) rows per second; horizontal scrolling: 4(4) columns per second.
Benchmarks 2: max rows of text accommodated: 190 (Sirius not tested).
Benchmark 3: max rows of numbers accommodated: 190 (Sirius not tested).
Price: Around £150.
Further information Microsoft Europe Ltd, Bulbourne House, Gossoms End, Berkhamstead, Herts HP4 3LP. Tel (04427) 75091.
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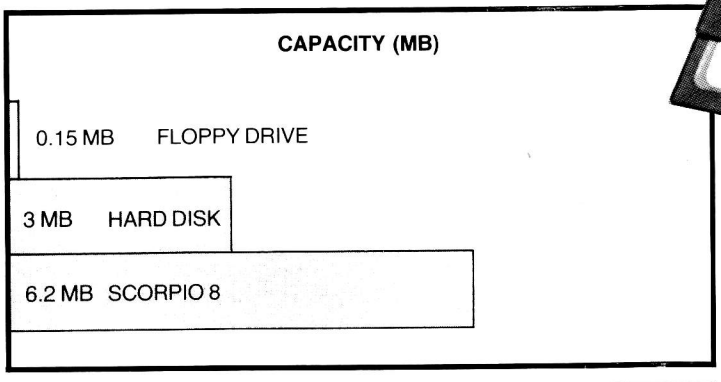

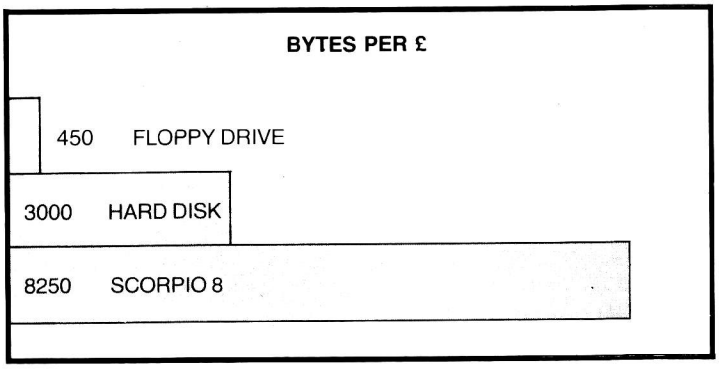

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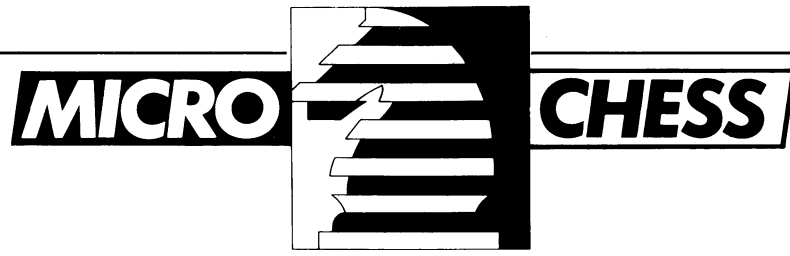

INTELLIGENT SOFTWARE

Tony Harrington reviews the history of David Levy and Kevin O'Connell's computer chess company.

Intelligent Software was founded by David Levy and Kevin O'Connell in 1981. But to trace its origins one has to go back some 12 years in time. For unlike the chess computer manufacturers we have looked at so far, where the drive and initiative has come from entrepreneurs who knew little about chess, both Levy and O'Connell began as professional chess players and chess writers.

With both, chess came first and computers second. O'Connell's introduction into computers began in 1969 when he had a brief spell working for IBM while a student studying history and politics at Exeter.

Levy had a rather more developed background in computers, gleaned during his days at St Andrews, where he studied statistics. But at that time computer chess was in its infancy and was almost exclusively the province of artificial intelligence specialists running programs on university mainframe computers.

O'Connell moved into writing and editing chess books as soon as he left Exeter University. He was in at the start of Batsford's massive publishing exercise and edited around 60 of the Batsford books — as well as having a hand in one way or another in another 38 opening, middle game and end game volumes published by Batsford.

Levy meanwhile concentrated on over-the-board play and won his international master title at a zonal tournament for the World Championship qualifying cycle in 1969. But by the early 1970s he too had become more involved in chess journalism and publishing.

According to O'Connell, the two of them met for the first time in 1970, but the meeting had no significance and contained no hint of the partnership that was to develop. After that they met on and off at various tournaments and functions, each continuing his writing activities independently of the other.

'By mid-1975 it was obvious that, between the two of us, we had secured a largish slice of whatever market there was for chess literature in the country — what we weren't writing, Raymond Keene was. We realised that we were having the same ideas about which books to write at roughly the same time — and that there wasn't much point in two people writing roughly similar versions of the same books. So we decided to pool our resources,' O'Connell remembered.

The two of them founded the Philidor Press. At this stage their interest was still almost completely in 'human' chess. Levy wrote ocasional pieces for the US *Chess* magazine and this led to his being invited to commentate on the games of the ACM computer chess tournament, held annually in the US. So there was some contact with computer chess.

Then, in 1967, Levy took the now famous bet that no computer program would be devised in the next ten years that would be able to beat him or any other master.

It happened by chance — as these things do — at the first major international chess tournament to be held in Dundee, Scotland for 100 years. Levy wasn't playing, but he happened to be at a party held in Edinburgh, made up of a mixed crowd of chess players from the tournament and artificial intelligence specialists from Edinburgh university.

Somehow the subject drifted round to computer chess, and the AI people began telling the chess-players that they were making great progress designing chess playing programs. The chess-players weren't particularly impressed, but the AI people were enthusiastic and so the bet came about. O'Connell was a little uncertain what the original sum was — perhaps £500. But it went up over the next few years as other people took a stake in it.

The bet found its way into the annals of chess literature, and most chess journalists mentioned it somewhere or other in their writing as the years went by.

It turned out to have something of an impact on the O'Connell-Levy partnership in rather an unexpected way. When 1977 came round at last, the bet culminated with Levy playing a match against Chess 4.7 the current world champion running on the CDC Cybero. He won, and the ensuing publicity brought Levy and O'Connell to the attention of Ernest Winkler of SciSys, who had just begun making chess computers and wanted help with the software.

Levy and O'Connell had already, by this stage, gained their first experience of the computer chess marketplace. Towards the end of 1977, before Winkler's approach, they had been contacted by Texas Instruments, which was then planning the launch of the TI99/4 personal computer.

TI wanted consultancy support in the design of a chess program. But this first venture didn't come off too well. As O'Connell put it, 'We gave them some good ideas; they had experts who thought they knew better and botched it up.'

The experience convinced Levy and O'Connell that if the chance came along to design another chess program they would keep control of the project themselves. SciSys gave them that opportunity at the end of 1978.

The two went out and hired a programmer, Mike Johnson (who, readers of this column might remember, won the most recent *PCW* 3rd European Microchess Tournament, in partnership with Dave Wilson). They discovered his chess programming talents during the *PCW* tournament of 1978. (Subsequent *PCW* tournaments have provided Levy and O'Connell with a fertile recruiting ground of proven chess programmers.)

The result of this collaboration was the SciSys Chess Champion Mk3, which sold very well for SciSys and was at one stage endorsed by Anatoly Karpov, according to O'Connell.

For the next three years, Philidor — as the company was still called — did a great deal of work for SciSys. In fact, aside from a brief flirtation with ACT, who wanted a chess program to run on Pet and Apple computers, the two worked almost exclusively for SciSys.

This relationship had its drawbacks as well as its advantages, since chess computer suppliers tend to oscillate between research and development and sales. When a good program comes along, things go quiet for the R & D team while the marketing side takes over and tries to turn the idea into profit.

By the beginning of 1981, it had occurred to Levy and O'Connell that it might be wise to loosen their relationship with SciSys and look for business elsewhere. More or less as a result of this decision, they began to recruit additional chess programming specialists — in particular Richard Lang, whose program Cyrus I won the 1981 *PCW* tournament.

In the summer of 1981 Levy and O'Connell delivered the Mk V module to SciSys. This went on to win the commercial chess computer world championship at Trevemunde — under somewhat clouded circumstances, thanks to withdrawals and bickering among the suppliers — that same year.

In the autumn of 1981 they set up Intelligent Software as a separate company, and went looking for clients and work. As people began to discover that they were no longer writing programs exclusively for SciSys, work began to look for them. Milton Bradley, one of the major toy manufacturers, had decided that sensory chess machines were all very well, but a chess computer that could move its own

pieces would be better still. It wanted someone to design a self-moving robotics chess machine and to program it.

Intelligent Software took the project on, and the machine is now commercially available — but that is a separate tale in its own right, and will have to wait for another column. While this was being developed, O'Connell approached Tandy with an idea for a bridge-tutor program for the Tandy Color Computer. That idea too, is now on sale in the shops (see the January edition of *What Micro).*

In January 1982 O'Connell and Levy went to the Las Vegas electronics fair, as they usually do, to see what the industry was doing or about to do. There they began talking to some people who distributed chess sets in Paris. They had had the idea for some time of marketing an improved version of the Cyrus program in a sensory board machine. But there had always been the logistical problem of manufacturing the units.

The Paris people said they would provide the facilities if Intelligent Software gave them consultancy support — and so the concept of La Regence (the top scoring commercial machine in last year's *PCW* tournament) was born.

According to O'Connell, La Regence has far and away the strongest blitz chess (five seconds a move) program of any commercially available unit. La Regence runs on a Z80 chip, with 12k ROM and 1k of RAM and has a 4 MHz clock. They took it to the ACM blitz tournament in 1981, when it was still on an Osborne microcomputer, and it excelled itself at the 5 seconds a move level. O'Connell reckoned that it destroyed the Cray blitz program (running on a Cray!), beat Chess 4.5 comfortably and only lost to Belle, the world's strongest program at the moment, with a FIDE ranking around the Master level. 'If we'd had anything like the hardware advantages that Belle enjoyed, I rather think that La Regence would have knocked the spots off it,' he commented modestly.

La Regence went on sale in France in November last year, priced at FF 4,000, or around the £400 mark. It isn't quite as grand a set, in appearance, as the Mephisto, but it plays a mean game of chess.

Games

The first game features Richard Lang's Cyrus, before the modifications which turned it into La Regence. The occasion is the 1981 *PCW* tournament. The second game is by La Regence itself, and is from last year's tournament.

White = Advance 2.0; Black = Cyrus (La Regence)

Cyrus's most complicated game in the tournament; complete accuracy in the commentary is not guaranteed. . .

1	e2-e4	c7-c5
2	Ng1-f3	Nb8-c6
3	d2-d4	c5xd4
4	Nf3xd4	Ng8-f6
5	Nb1-c3	d7-d6
6	Bc1-g5	e7-e5?!
7	Nd4-b5	

(Transposing into 'normal' lines, the *Encyclopaedia of Chess Openings* gives 7 Bg5xf6 g7xf6 8 Nd4-f5 with advantage. La Regence has a much larger openings 'book' than did the Cyrus program when it played this game.)

7	. . .	a7-a6
8	Bg5xf6	g7xf6
9	Nb5-a3	Bc8-e6
10	Bf1-c4	

('Theory' gives 10 Na3-c4 or 10 Nc3-d5.)

10	. . .	Qd8-b6?!
11	Bc4xe6	f7xe6

(Now White of course can unsettle the Black king, though the central pawn mass gives it fair protection; after 12 Qd1-h5 + Ke8-e7, White can choose either 13 0-0-0, or else 13 Ra1-b1 and 14 0-0. Instead. . .)

12	Na3-c4?!	Qb6-b4
13	Qd1-e2?	

(He must play 13 Qd1-d3, when (eg) 13 . . . NC6-d4 14 0-0-0 Ra8-c8 15 Nc4-e3 is okay.)

13	. . .	d6-d5?!

(Black is now very probably winning, but he is making things unnecessarily complicated. Instead, 13 . . . Nc6-d4! wins quite comfortably. 14 Qe2-d3 Ra8-c8, and if 15 b2-b3, b7-b5, etc.)

14	Qe2-h5+	

(Or 14 e4xd5 Nc6-d4 15 Qe2-h5+, transposing.)

14	. . .	Ke8-e7

(Looks adequate to keep Black on top, though 14 . . . Ke8-d8 — denying White the subsequent gain of tempo with d5-d6+ — might be a shade better; the play could then be similar to that given in the next four notes.)

15	e4xd5	Nc6-d4!

(And not 15 . . . e6xd5 16Nc4-e3, when White is out of trouble.)

16	Nc4-e3	

(Or 16 d5-d6+ Ke7-d8 17 Qh5-f7 Qb4xc4 18 Qf7xf6+ Kd8-d7 19 Qf6-f7+. Not 19 Qf6xh8 Nd4xc2+ 20Ke1-d1 Qc4-d3+ 21 Kd1-c1 Bf8-h6+ 19 . . . Kd7xd6, and Black should consolidate and win, eg, if 20 0-0-0, Qc4-c7 appears to work.)

16	. . .	Qb4xb2
17	d5-d6+	

(17 0-0 Qb2xc3 18 d5xe6 is a possible alternative try, though at the very least Black can emerge with a sound extra pawn after 18 . . . Ke7xe6 19 Qh5-h3+ Ke6-f7 20 Qh3-d7+ Bf8-e7 21 Qd7xe7+ Kf7xe7 22 Ne3-d5+ Ke7-e6 23 Nd5xc3 Nd4xc2.)

17	. . .	Ke7-d8!
18	Ke1-d2	

(Now White has no chance. He had to try 18 0-0 Qb2xc3 19 Qh5-f7, with some sort of attacking chances for the piece, though after, eg, 19 . . . Bf8xd6 20 Qf7xf6+ Kd8-d7 21 Ra1-b1 b7-b5 they shouldn't be sufficient.)

18	. . .	Ra8-c8
19	Nc3-e4	Nd4xc2
20	Ne3xc2	Qb2xc2+
21	Kd2-e3	Rc8-c4
22	Qh5-h4	Bf8-h6+
23	Ke3-f3	

(If 23 Qh4xh6 then 23 . . . Rc4xe4+ 24 Ke3-f3 Qc2-e2+ 25 Kf3-g3 Qe2-g4 mate.)

23	. . .	Qc2-d3+
24	Kf3-g4	Qd3xe4+
25	Kg4-g3	0-1

GAME 2

London 1982 (*PCW* Show)

White=Bogol; Black=La Regence

Bogoljubow Indian Defence

1	d2-d4	Ng8-f6
2	c2-c4	e7-e6
3	Ng1-f3	Bf8-b4+
4	Bc1-d2	Qd8-e7
5	e2-e3	Nb8-c6

(Coincidentally, the day this game was played, Harry Golombek wrote in *The Times,* criticising ex-World Champion Tigran Petrosian for failing to play . . . Nb8-c6 in this very variation. La Regence had obviously read the newspaper before the game started!)

6	Bf1-d3	d7-d5
7	a2-a3	Bb4xd2+
8	Nb1-d2	d5xc4
9	Nd2xc4	0-0
10	0-0	Bc8-d7
11	Ra1-c1	Nf6-d5
12	Qd1-c2	f7-f5

(An ugly move, which leaves Black with a 'hole' on e5, but it is not easy in the short term to take advantage of this concession.)

13	b2-b4	Rf8-f6
14	b4-b5	Nc6-B8
15	a3-a4	Nd5-b4
16	Qc2-b1	Nb4xd3
17	Qb1xd3	a7-a6!

(Now, either White must capture on a6 and allow Black's b8 knight to redevelop, or permit Black to exchange pawns on b5. In either case White gets saddled with an isolated pawn on the queen side.)

18	Nc4-e5	a6xb5
19	Rc1xc7	

GOTO page 232

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- Copies protected programs from 13-sector to 16-sector disks
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*One drive and Language Card/16K card required.
Works with most popular cards, including Apple, Microsoft, Ramex, Digitek, MPC, RH Electronics, Orange, Franklin, etc.
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pieces would be better still. It wanted someone to design a self-moving robotics chess machine and to program it.

Intelligent Software took the project on, and the machine is now commercially available — but that is a separate tale in its own right, and will have to wait for another column. While this was being developed, O'Connell approached Tandy with an idea for a bridge-tutor program for the Tandy Color Computer. That idea too, is now on sale in the shops (see the January edition of *What Micro).*

In January 1982 O'Connell and Levy went to the Las Vegas electronics fair, as they usually do, to see what the industry was doing or about to do. There they began talking to some people who distributed chess sets in Paris. They had had the idea for some time of marketing an improved version of the Cyrus program in a sensory board machine. But there had always been the logistical problem of manufacturing the units.

The Paris people said they would provide the facilities if Intelligent Software gave them consultancy support — and so the concept of La Regence (the top scoring commercial machine in last year's *PCW* tournament) was born.

According to O'Connell, La Regence has far and away the strongest blitz chess (five seconds a move) program of any commercially available unit. La Regence runs on a Z80 chip, with 12k ROM and 1k of RAM and has a 4 MHz clock. They took it to the ACM blitz tournament in 1981, when it was still on an Osborne microcomputer, and it excelled itself at the 5 seconds a move level. O'Connell reckoned that it destroyed the Cray blitz program (running on a Cray!), beat Chess 4.5 comfortably and only lost to Belle, the world's strongest program at the moment, with a FIDE ranking around the Master level. 'If we'd had anything like the hardware advantages that Belle enjoyed, I rather think that La Regence would have knocked the spots off it,' he commented modestly.

La Regence went on sale in France in November last year, priced at FF 4,000, or around the £400 mark. It isn't quite as grand a set, in appearance, as the Mephisto, but it plays a mean game of chess.

Games

The first game features Richard Lang's Cyrus, before the modifications which turned it into La Regence. The occasion is the 1981 *PCW* tournament. The second game is by La Regence itself, and is from last year's tournament.

White = Advance 2.0; Black = Cyrus (La Regence)

Cyrus's most complicated game in the tournament; complete accuracy in the commentary is not guaranteed. . .

1	e2-e4	c7-c5
2	Ng1-f3	Nb8-c6
3	d2-d4	c5xd4
4	Nf3xd4	Ng8-f6
5	Nb1-c3	d7-d6
6	Bc1-g5	e7-e5?!
7	Nd4-b5	

(Transposing into 'normal' lines, the *Encyclopaedia of Chess Openings* gives 7 Bg5xf6 g7xf6 8 Nd4-f5 with advantage. La Regence has a much larger openings 'book' than did the Cyrus program when it played this game.)

7	. . .	a7-a6
8	Bg5xf6	g7xf6
9	Nb5-a3	Bc8-e6
10	Bf1-c4	

('Theory' gives 10 Na3-c4 or 10 Nc3-d5.)

10	. . .	Qd8-b6?!
11	Bc4xe6	f7xe6

(Now White of course can unsettle the Black king, though the central pawn mass gives it fair protection; after 12 Qd1-h5 + Ke8-e7, White can choose either 13 0-0-0, or else 13 Ra1-b1 and 14 0-0. Instead. . .)

12	Na3-c4?!	Qb6-b4
13	Qd1-e2?	

(He must play 13 Qd1-d3, when (eg) 13 . . . NC6-d4 14 0-0-0 Ra8-c8 15 Nc4-e3 is okay.)

13	. . .	d6-d5?!

(Black is now very probably winning, but he is making things unnecessarily complicated. Instead, 13 . . . Nc6-d4! wins quite comfortably. 14 Qe2-d3 Ra8-c8, and if 15 b2-b3, b7-b5, etc.)

14	Qe2-h5+	

(Or 14 e4xd5 Nc6-d4 15 Qe2-h5+, transposing.)

14	. . .	Ke8-e7

(Looks adequate to keep Black on top, though 14 . . . Ke8-d8 — denying White the subsequent gain of tempo with d5-d6+ — might be a shade better; the play could then be similar to that given in the next four notes.)

15	e4xd5	Nc6-d4!

(And not 15 . . . e6xd5 16Nc4-e3, when White is out of trouble.)

16	Nc4-e3	

(Or 16 d5-d6+ Ke7-d8 17 Qh5-f7 Qb4xc4 18 Qf7xf6+ Kd8-d7 19 Qf6-f7+. Not 19 Qf6xh8 Nd4xc2+ 20Ke1-d1 Qc4-d3+ 21 Kd1-c1 Bf8-h6+ 19 . . . Kd7xd6, and Black should consolidate and win, eg, if 20 0-0-0, Qc4-c7 appears to work.)

16	. . .	Qb4xb2
17	d5-d6+	

(17 0-0 Qb2xc3 18 d5xe6 is a possible alternative try, though at the very least Black can emerge with a sound extra pawn after 18 . . . Ke7xe6 19 Qh5-h3+ Ke6-f7 20 Qh3-d7+ Bf8-e7 21 Qd7xe7+ Kf7xe7 22 Ne3-d5+ Ke7-e6 23 Nd5xc3 Nd4xc2.)

17	. . .	Ke7-d8!
18	Ke1-d2	

(Now White has no chance. He had to try 18 0-0 Qb2xc3 19 Qh5-f7, with some sort of attacking chances for the piece, though after, eg, 19 . . . Bf8xd6 20 Qf7xf6+ Kd8-d7 21 Ra1-b1 b7-b5 they shouldn't be sufficient.)

18	. . .	Ra8-c8
19	Nc3-e4	Nd4xc2
20	Ne3xc2	Qb2xc2+
21	Kd2-e3	Rc8-c4
22	Qh5-h4	Bf8-h6+
23	Ke3-f3	

(If 23 Qh4xh6 then 23 . . . Rc4xe4+ 24 Ke3-f3 Qc2-e2+ 25 Kf3-g3 Qe2-g4 mate.)

23	. . .	Qc2-d3+
24	Kf3-g4	Qd3xe4+
25	Kg4-g3	0-1

GAME 2

London 1982 (*PCW* Show)

White=Bogol; Black=La Regence

Bogoljubow Indian Defence

1	d2-d4	Ng8-f6
2	c2-c4	e7-e6
3	Ng1-f3	Bf8-b4+
4	Bc1-d2	Qd8-e7
5	e2-e3	Nb8-c6

(Coincidentally, the day this game was played, Harry Golombek wrote in *The Times,* criticising ex-World Champion Tigran Petrosian for failing to play . . . Nb8-c6 in this very variation. La Regence had obviously read the newspaper before the game started!)

6	Bf1-d3	d7-d5
7	a2-a3	Bb4xd2+
8	Nb1-d2	d5xc4
9	Nd2xc4	0-0
10	0-0	Bc8-d7
11	Ra1-c1	Nf6-d5
12	Qd1-c2	f7-f5

(An ugly move, which leaves Black with a 'hole' on e5, but it is not easy in the short term to take advantage of this concession.)

13	b2-b4	Rf8-f6
14	b4-b5	Nc6-B8
15	a3-a4	Nd5-b4
16	Qc2-b1	Nb4xd3
17	Qb1xd3	a7-a6!

(Now, either White must capture on a6 and allow Black's b8 knight to redevelop, or permit Black to exchange pawns on b5. In either case White gets saddled with an isolated pawn on the queen side.)

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NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering the microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them elsewhere. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary.** Binary is a system of numbering which uses base 2 instead of the more familiar decimal — or, to be more accurate, denary-system of base 10. In binary notation there are only two digits — 0 and 1 — which the computer recognises as the absence or presence of an electric current. The easiest way to visualise this is to think of each binary digit **(bit)** as being a switch which can be either off or on. Each binary digit stands for a power of 2. The right-most digit, the least significant, is $2^0=1$, the next $2^1=2$, then $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, $2^8=256$. So decimal 24, for example, is represented in binary as 00011000. A set of eight bits is known as a **byte** and, to make things easier for humans, a third system of numbering, **hexadecimal** or **hex** for short, is used as a sort of 'halfway house' between binary and denary. Hex uses numbers to base 16, with denary numbers between 9 and 16 represented by the letters A-F. The hex equivalent of a byte is obtained by giving each half a single character code: 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 ... E=1110 and F=111. Our example of 24 is therefore 18 in hex.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). This allocates a numerical code to each digit and letter. For example, the number 5 is given the ASCII code 35 hex, 53 decimal, whereas a capital A is represented by ASCII 41 hex, 65 decimal.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex **(machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic.** Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter,** which is usually built into the machine's ROM (see later paragraph on this page). The interpreter picks up each Basic instruction, translates it into machine code and then feeds it to the **processor** for execution. It has to do this each time the same instruction has to be executed. A much faster method is to use a **compiler,** which accepts each instruction in turn, waits until the program has been entered, then turns each instruction into machine code before running the program. This means that each instruction has to be translated once only — consequently the speed of execution is considerably improved.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE.** They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware,** this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU),** a single microprocessor chip with supporting devices such as **buffers,** which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100.**

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Erasable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks,** each of which is in turn subdivided into **sectors.** Using a program called a **disk operating system,** the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface, and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

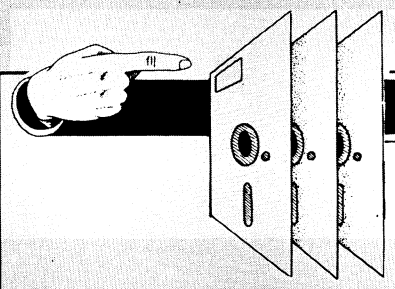
Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for microcomputers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU),** which looks like a TV screen with a typewriter-style **keyboard;** sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer.**

The computer can send out and receive information in two forms — **parallel** and **serial.** Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

The ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24)** while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone system, allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler,** which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.



PACKAGES

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: **Dick Olney,** *PCW,* **62 Oxford Street, London W1.**

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.
All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT	021-454 8585
A2	Arden Data Processing	0533 22255
A3	ADP Network services	01 388 1912
A4	Alamo Comp. Serv.	0642-310381
A5	Anthony Ashpitel	0379 852807
A6	Attar Computers	0942 608844
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	061-831-7292
B3	Benchmark Computer Systems	0726 61000
B4	Bristol Software Factory	0272 23430
B5	Byte Soft Systems Ltd	0480 215005
B6	Business Solutions Ltd	01-554-5985
B7	Bromley Computer Consultancy	01 464 8080
C1	CAP-CPP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	0507-604271
C5	Computastore Ltd.	061-832-4761
C6	Computech	01-794 0202
C7	Compass	Standish 426252
C8	CWP Computers	01-828 3127
C9	C4 Computer Services	0632-664313
C10	Caxton Software	01 379 6502
C11	CBS Consultants	021-722-8181
C12	Comp Prog & Systems Serv	0942-38831
E1	Engineering Sciences	01-437-4894
G1	Graffcom Systems Ltd.	01-727 5561
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
G4	Gecas Micros	01-629 3758
G5	Grade One	Glossop 63819
H1	A.J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922
H4	Wordcraft Systems	0332 760127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	0276 20446
K2	Keen Computers	0602 412777
L1	Lifeboat Associates	01-836 9028
L2	EMG	0293 519211
L3	Ludhouse (Computing) Ltd.	01-679 4321
L4	Logic Comp Systems	01-222-1122
M1	Micro Computer Applications Ltd.	0734 470425
M2	Microteck.	Orpington 26803
M3	Microsys Ltd	051 426 7271
M4	Microsave	0272 737555
M5	M.A.P. Comp Systems	061-624-5662
M6	Mercator	0272 731079
M7	Micros For The Movement	01-387 6192
M8	MMG Consultants	06845 63555
M9	Mediatech	01-903 4372
O1	Omicron Design	0784 31809
P1	Padmede Computer Services	0251 421892
P2	Personal Computers Ltd.	01-377 1200
P3	Professional Computer Services	061 624 4065
P4	Prestige Computers	021 561 2001
Q1	Quill Computer Systems.	061 477 4960
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 735656
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-904 8139
S8	SD Micros	01 836 9520
S9	Southdata Ltd	01-994 6477
T1	Tridata Micros Ltd.	021 622 6085
T2	Templeman Software	0789 66237
T3	The Micro Solution	0608 3256
T4	Terodec Ltd	0734-664343
T5	TABS Ltd	0264-58933
T6	Tip Data Ltd	0375-33910
V1	Vlasak Electronics Ltd.	0494-448633
V2	Vauntberry Ltd	0329 235846
W1	Wisbech Computer Services	0945 64146
W2	Westfarthing Comp Services	03265-4098
W3	Walters Computer Systems Ltd	04492 70811
W4	Western Computers	0253 404676
X1	Xetal	061 682 7555

APPLICATIONS

Application	Machine	Price	Code
Analysis ledger	Philips P2000	£100	P4
Appointments planner	Act Sirius 1	£115	C7
	Apple II	£300	A6
	Challenger	£25	C7
	CP/M	POR	G4
Arable recording & costing	CP/M	£1500	C4
Architects package	CP/M	£990	M6
Assembler dev	PET/CBM	£50	L2
Auction package	CP/M	£700	M6
Bill of materials	Apple II	£199	T5
	CP/M	£850	B5
	CP/M	£199	T5
	CP/M	£400	G4
	CP/M	£850	V2
	Cromemco	£850	B5
	PET/CBM	£199	T5
	Superbrain	£450	T3
Bookmakers package	CP/M	POR	B7
Bookshop stock control	Sorcerer	£1450	L2
Budgeting package	Apple II	£125	P2
	Apple II	£125	T2
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Building estimating	Apple II	£570	S8
Bureau de change	PET/CBM	£8	H3
Cash flow	Apple II	£125	P2
	Apple II	£80	V1
	Apple II	£100	C8
	CP/M	£250	L3
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Bursar package	CP/M	POR	M8
Car showroom sales	Sorcerer	£1900	L2
Cash register	CP/M	£300	T4
Cheque writer	CBM/8032	£90	P3
	PET/CBM	£90	P3
Company secretary	CP/M	£650	C4
Construction cashflow	Apple II	£75	S8
Construction expenditure	Apple II	£250	S8
Construction financial control	Apple II	£750	S8
Construction valuations	Apple II	£500	S8
Container accounting	CP/M	£750	M5
Contract costing	Apple II	£500	P1
	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II	£98	P2
	CP/M	POR	G4
	PET/CBM	£650	B4
Customer file	CP/M	£900	G4
	Famos	£1000	M2
Dairy mangement	CP/M	£1500 +	C4
Database management/Information retrieval	ACT800	£225	H4
	Apple II	£150	A2
	Apple II	£150	K2
	Apple II	£60-140	S2
	Apple II	£150	S5
	Apple II	£75	P2
	Apple II	£100	S4
	Apple II	£100	C8
	Apple II	£125	T2
	CP/M	£450	C4
	CP/M	£100	G3
	CP/M	£350	B3
	CP/M	£400	C3
	CP/M	£600	G5
	CP/M	£225-485	S9
	Famos	£1500	M2
	North Star Horizon	£250	B3
	PET/CBM	£250	C3
	PET/CBM	£225	H4
	PET/CBM	£75	B1
	PET/CBM	£50/150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	Superbrain	£300	S6
	Tandy Model 1	£25-80	M1
	Tandy Model 1	£60	S2
	Tandy Model 1	£150	J1
	Tandy Model 1	£32.50	H1
	Tandy Model 111	£270	A4
	8000 Series	POR	C2
Debt collection	CP/M	£550	G4
	CP/M	£450	V2
Dental laboratory	Apple II	£280	A6
Dental records	Apple II	£395	M4
	Apple II	£1700	A6
	CP/M	£500	T4
Department store order program	Sorcerer	£2500	L2
Disk operating system	PET/CBM	£150	B1
Double glazing costing	North Star Horizon	£750	W1
	CP/M	£1500	V2
Eire payroll system	CP/M	£650	M5
Estate agent	Apple II	£850	A2
	Apple II	£850	S5
	Apple II	£850	K2
	Apple II	£175	P2
	Apple II	£130	C8
	Apple II	£750	S4
	PET/CBM	£30	H3
	CP/M	£700	B5
	CP/M	£850	S9
	PCC 2000 Simpelec Triton 3	£350	B3
	MZ-80K	£195	W1
	Superbrain	£600	S6
	Superbrain	£600	C12
Equipment lease/rent/HP	CP/M	£400	G1
Expense analysis	Philips P2000	£150	P4
Farm accounts	CP/M	£750	C4
Financial & arable management	CP/M	£2200	C4
File handling	PET/CBM	£225	H4
Financial modelling	Act Sirius 1	£595	A1
	Apple II	£450	P2
	Apple II	£360	C8
	CP/M	£400	G1
	CP/M	£95	B5
	CP/M	£425-535	A1
	CP/M	£400	B6
	CP/M	£400	V2
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£425-535	A1
	RAIR Black Box	POR	A3
Financial planning	Act Sirius 1	£150	A1
	Apple II	£250	S4
	CP/M	£245	G4
General ledger/NL	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£455	P2
	Apple II	£225	V1
	Apple II	£295	C6
	Apple II	£250P	S4
	Apple II	£600	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£450	C11
	CBN/8032	£350	W3
	CP/M	£500	L3
	CP/M	£375	L1
	CP/M	£400	G1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S6
	CP/M	£390	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£950/1250	V2
	CP/M	£400	M9
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000 North Star Horion	£400	B5
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£200	C2
	PET/CBM	£200	H3
	PET/CBM	£199	T5
	Philips P2000	£100	P4
	Sharp PC3201	£450	P2
	Superbrain	£400	M3
	Superbrain	£400	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model 1	£225	H1
	Tandy Model 1	£225/325	T1
	Tandy Model 11	£425	T1
	Vector	£400	C5
	8080/Z80	£357	L1
	8080/Z80	£275	G3
General purchase transaction proc.	CBM/8032	£495	S3
Greyhound race program	Apple II	£750	M6
Health authority PPM	Sorcerer	£2500	L2
Housing association package	PET/CBM	POR	M7
Hotel billing	Philips P2000	£500	P4
Hotel management	Apple II	£525	M4
	CP/M	£525	M4
	RAIR Black Box	POR	A3

PACKAGES

Application	Machine	Price	Code
Incomplete records	Act Sirius 1	£1200	S1
	Apple II	£250	S2
	Apple II	POR	K2
	Apple II	£425	P2
	Apple II	£450	P1
	Apple II	£490	L4
	CBM/8032	£150	W3
	CP/M	£750	M3
	CP/M	£250	B5
	CP/M	£975	B3
	CP/M	£750	W1
	CP/M	£1250	M5
	CP/M	£155	C10
	CP/M	£400	G4
	Cromemco	£250	B5
	North Star Horizon	£750	M3
	North Star Horizon	£250	B5
	North Star Horizon	£975	B3
	Philips P2000	£150	P4
	Superbrain	£750	M3
	Superbrain	£1200	S1
	Tandy Model 1	£40	M1
	Tandy Model 1	£40	H1
Industrial cleaning package	CP/M	POR	B7
Industry Factory loading	Apple II	£360	X1
	CP/M	£360	X1
	PET/CBM	£300	X1
Industry work study	Apple II	£990	X1
	CP/M	£990	X1
	PET/CBM	£750	X1
Inn Management	Act Sirius 1	£185	C7
Instrument logging	Sorcerer	£500	L2
Insurance broker	Act Sirius 1	£450	C7
	CP/M	POR	G4
Insurance renewals	CBM/8032	£1200	S3
Integrated accts	Act Sirius 1	£795	O1
	Altos (CP/M, MP/M)	£300	B1
	Apple II	£450	P1
	Apple II	£300	P2
	Apple II	£855	V1
	Apple II	£600	T2
	Apple II	£1470	L4
	Apple II	£300	W2
	Apple II	£199	T5
	CBM/8032	£1500	P3
	CBM/8032	900	C11
	CP/M	£950	L1
	CP/M	£750	C4
	CP/M	£1100	G1
	CP/M	£990	M3
	CP/M	£690	B5
	CP/M	£900	B5
	CP/M	£1450	B3
	CP/M	£1200	B6
	CP/M	£199	T5
	CP/M	£3400	M9
	Cromemco	£690	B5
	Cromemco	£900	B5
	Famos	£2000	M2
	MZ-80K	£150	P2
	North Star Horizon	£950	B3
	North Star Horizon	£690	B5
	North Star Horizon	£900	B5
	PET/CBM	£300	B1
	PET/CBM	£800	S3
	PET/CBM	£199	T5
	North Star Horizon	£990	M3
	PET/CBM	(£50)	C2
	PET/CBM	£650	J1
	PET/CBM	£650	G2
	Philips P2000	£650	P4
	Superbrain	£990	M3
	Superbrain	£1200	S6
	Superbrain	£1000	T3
	Superbrain	£1200	S1
	Tandy Model I	£350	M1
	Tandy Model II	£350	M1
	Tandy Model I	£75	J1
	Tandy Model II	£795	O1
	Tandy Model III	£550	A4
	Vector	£1000	C5
	8000 Series	POR	C2
	8080/Z80	£950	L1
	8080/Z80	£995	G3
Investment portfolio	Tandy Model I	£20	S2
Invoicing	Act Sirius 1	£95	C7
	Act Sirius I	£265	O1
	Act Sirius I	£195	A1
	Apple II	£295	S2
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£140	V1
	Apple II	£300	T2
	Apple II	£199	T5
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£250	M3
	CP/M	£250	S7
	CP/M	£100	B5
	CP/M	£200	B3
	CP/M	£300	W1
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£400	G4
	CP/M	POR	W4
	CP/M	£400	M9
	Cromemco	£100	B5
	North Star Horizon	£100	B3
	North Star Horizon	£250	M3
	North Star Horizon	£100	B5
	PET/CBM	£350	A1
	PET/CBM	£25-50	B1
	PET/CBM	POR	J1
	PET/CBM	£199	T5
	Philips P2000	£150	P4
	Sorcerer	£290	L2
	Superbrain	£250	M3
	Superbrain	£150	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£25	H1
	Tandy Model I	£75	T1
	Tandy Model II	£125	T1
	Tandy Model II	£265	O1
	Tandy Model III	£280	A4
	8080/Z80	£325	L1
Jewellers System	CP/M	£1000	S7
	CP/M	POR	G4
Job costing	Act Sirius 1	£350	C7
	Act Sirius 1	£265	O1
	Apple II	£300	P1
	Apple II	£990	X1
	Apple II	£199	T5
	CBM/8032	£1000	C11
	CBM/8032	£350	W3
	CP/M	£350	M3
	CP/M	£990	X1
	CP/M	£500	T4
	CP/M	£650	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£1500	T6
	CP/M	£1500	V2
	North Star Horizon	£350	M3
	PET/CBM	£750	X1
	PET/CBM	£199	T5
	Philips P2000	£400	P4
	Superbrain	£350	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
	Tandy Model II	£265	O1
Job order control	8080/Z80	£275	G3
Legal precedents	CP/M	£1150	C4
Letter writer	Apple II	£80	V1
	Apple II	£99	T5
	CP/M	£150	M3
	CP/M	£99	T5
	CP/M	POR	G4
	North Star Horizon	£150	M3
	Superbrain	£150	M3
Local government housing maint	RAIR Black Box	POR	A3
Lotteries	PET/CBM	£45	H2
Magazine subscriber	CP/M	£950	S9
Mailing List	Altos (CP/M, MP/M)	£75	B1
	Apple II	£300	A2
	Apple II	£50-150	S2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£40	P2
	Apple II	£100	S4
	CP/M	£450	C4
	CP/M	£250	G1
	CP/M	£75	S9
	CP/M	POR	G4
	North Star Horizon	£195	W1
	PET/CBM	£45	H2
	PET/CBM	£15	A1
	PET/CBM	£75	B1
	PET/CBM	£35	H3
	Sorcerer	£290	L2
	Superbrain	£140	C9
	Tandy Model 1	£40	M1
	Tandy Model II	£75	M1
	Tandy Model I	£50-150	S2
	Tandy Model I	£25/38/55	H1
Mail shot	Act Sirius I	£95	A1
	Apple II	£14	S2
	Apple II	£40	P2
	Apple II	£25	T2
	Apple II	£99	T5
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£450	C4
	CP/M	£90	M3
	CP/M	£100	S7
	CP/M	£50/150	G5
	CP/M	£99	T5
	MCZ Zilog	£250	I1
	North Star Horizon	£90	M3
	PCC 2000		
	Simplec Triton 3	£450	B2
	Superbrain	£90	M3
	Tandy Model I	£75+	G4
	Tandy Model II	£75	M1
	Tandy Model II	£75+	G4
	Tandy Model III	£160	A4
Membership accting	Apple II	£75	P2
	CP/M	POR	G4
	MCZ Zilog	£250	I1
	PET/CBM	£85	H2
Motor Dealer	Act Sirius I	£345	C7
	CBM/8032	£950+	P3
	CP/M	POR	G4
	Famos	£5000	M2
NEDO price adjustment	Apple II	£200	S8
Order entry/ invoicing	Apple II	£99	T5
	CBM/8023	£750	P3
	CP/M	£350	G1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	£550	L1
	CP/M	POR	B7
	CP/M	£99	T5
	CP/M	£400	M9
	8080/Z80	£550	L1
Order Processing	AppleII	£99	T5
	CP/M	£99	T5
	CP/M	£500	G4
	CP/M	£400	M9
	Philips P2000	£200	P4
Office admin	Apple II	£100	S4
Pad to plotter systems	Apple II	£250	P2
	Apple II	£180	C8
Payroll	Act Sirius I	£300+	O1
	Act Sirius I	£195	A1
	Apple II	POR	A2
	Apple II	£200	S2
	Apple II	POR	S5
	Apple II	POR	K2
	Apple II	£200	P2
	Apple II	£375	V1
	Apple II	£375	C6
	Apple II	£250P	S4
	Apple II	£400	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£375	P3
	CBM/8032	£350	W3
	Challenger	£24	C7
	CP/M	£450	L3
	CP/M	£475	L1
	CP/M	£450	C4
	CP/M	£500	G1
	CP/M	£390	M3
	CP/M	£500	B5
	CP/M	£450	B3
	CP/M	£425	B6
	CP/M	Lease	W1
	CP/M	£500	T4
	CP/M	£450	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£395	G4
	CP/M	POR	W4
	CP/M	£600	M9
	Famos	£1500	M2
	North Star Horizon	£350	B3
	North Star Horizon	£390	M3
	North Star Horizon	Lease	W1
	PET/CBM	£200/350	C5
	PET/CBM	£50/195	I2
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	PET/CBM	£10	H3
	PET/CBM	£199	T5
	Philips P2000	£300	P4
	Scorcerer	£250	L2
	Superbrain	£390	M3
	Superbrain	£400	S6
	Superbrain	£250+	T3
	Tandy Model 1	£249	M1
	Tandy Model I	£200	H1
	Tandy Model I	£218	T1
	Tandy Model II	£375	T1
	Tandy Model II	£300+	O1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Sorcerer	£250	L2
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-80I	£218	K1
	TRS-80I	£218	T1
	TRS-80II	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
Perpetual Inventory	CP/M	£150	B5
	Cromemco	£150	B5
Personnel records	Apple II	£98	P2
	CP/M	£450	C4
	MCZ Zilog	£400	I1
	PET/CBM	£85	H2
Petaid report generator	PET/CBM	£250	S3
Petsoft programs	PET/CBM	£160	J1
Pig management	CP/M	£1250	C4
Point of sale	CP/M	£400	M9
Postal advertising response package	Apple II	£350	S2
Price lister	PET/CBM	£12	H3
Product Management	Act Sirius I	£245	C7
Production analysis	Apple II	£75	P2
	PET/CBM	£300	B1

INTER-OFFICE MEMORANDUM

John
Saw this in Personal Computer World would like demo A.S.A.P please action
M.B.

symb/net. *(n) (see fig 1)* **1.** speedy long range, local area network system, capable of ranges to 9km. utilises fibre optic cable and semi conductor laser to transmit data; **symbnet** enables user to link various microcomputers supported by **symbfile** *(see below)* **2.** compatible with DOS,PASCAL,CP/M; transfer rate 50 kHZ, transmission power 800 micro W cable, fire retardant P.V.C. grade 32, signal insensitive to electrical noise, ∴ cannot be corrupted; system nucleus **symbfile** *(see below).*

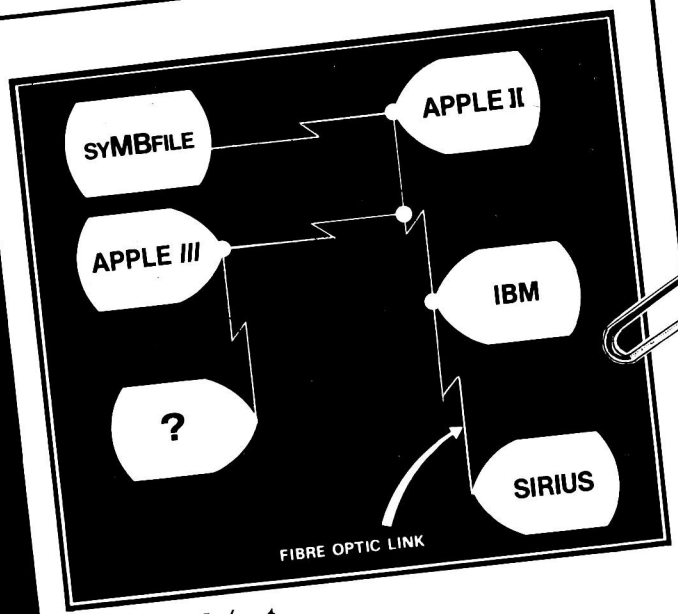


fig 1 **symb/net.**

symb/file *(n) (see fig II)* **1.** high capacity, high quality, $5\frac{1}{4}''$ Winchester sub-system, compatible with most microcomputers including APPLE II, III, IBM PC, and SIRIUS. Other features include **2.** a cold booting facility **3.** one year's full warranty. Also available on **symbfile** top quality software including database, word processing and accounting packages. **4.** capacities range from 3-84 megabytes; average speed of access 90ms, 32 sectors per track; rotational speed 3600 (rpm) **5.** used at the centre of network system — **symbnet** *(see above)*.

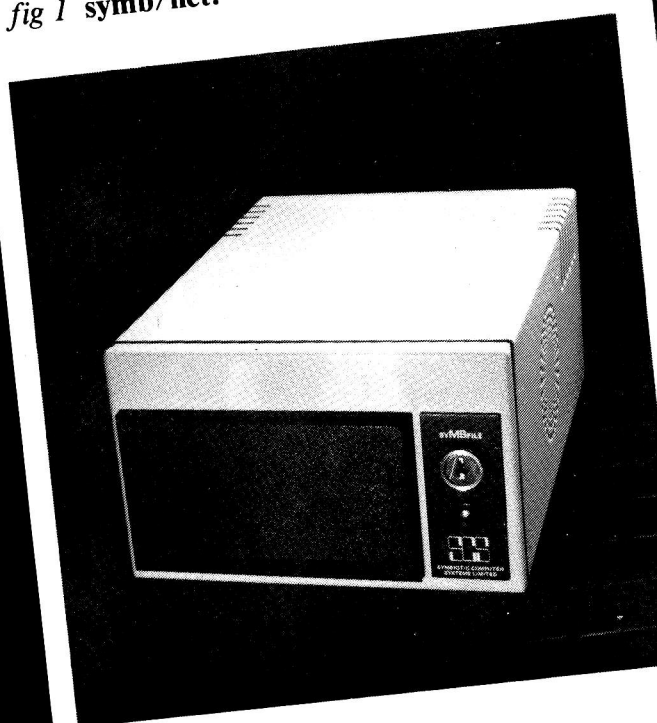


fig II **symb/file**

Symbiotic Computer Systems Ltd.
32 Elmwood Road, Croydon, CR9 2TX. Telephone: 01-683 1137 (PBX) Telex: 8938

APPLE IBM PC SIRIUS CP/M PASCAL DOS

BRITISH TECHNOLOGY AT ITS BEST

PACKAGES

Application	Machine	Price	Code
Production control	CBM/8032	£650+	P3
	CP/M	£2400	V2
	PET/CBM	£650+	P3
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£750--15000	C4
	CP/M	£400	M3
	CP/M	POR	B7
	North Star Horizon	£400	M3
	Superbrain	£400	M3
Publishers System	CP/M	£1850	S7
Purchase ledger	Act Sirius I	£395	A1
	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
	Challenger	£25	C7
	CBM/8032	£500	C11
	CBM/8032	£350	W3
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£395	S7
	CP/M	350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£950--1250	V2
	CP/M	POR	W4
	CP/M	£400	M9
	CP/M	£400	G4
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	Sorcerer	£490	L2
	Superbrain	£400	M3
	Superbrain	£300	S6
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/CBM	£350	H3
	PET/CBM	£199	T5
	Philips P2000	£200	P4
	Sharp PC3201	£300	P2
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Quotation estimating	Act Sirius I	£125	C7
	Apple II	£300	P1
	CP/M	POR	G4
	Philips P2000	£400	P4
Recruitment Agency	Act Sirius I	£345	C7
Reinforcement bar schedule	Apple II	£150	S8
Renewals ledger	Philip P2000	£200	P4
Report generator	CP/M	POR	G4
Requirements planning	CP/M	£700	V2
Resource optimiser	Apple II	£295	C10
Sales ledger	Act Sirius I	£395	A1
	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£500	C11
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£365	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£400	G4
	CP/M	£950--1250	V2
	CP/M	POR	W4
	CP/M	£400	M9
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/CBM	£350	C7
	PET/CBM	£199	T5
	Philips P2000	£200	P4
	Sharp PC 3201	£300	P2
	Sorcerer	£490	L2
	Superbrain	£400	M3
	Superbrain	£300	S6
	Superbrain	£199	T5
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
S/L, P/L & stock control	Apple II	£900	P2
	Apple II	£1000	T2
	CP/M	£1000	L3
	CP/M	£900	B5
	CP/M	£900	G4
	CP/M	£1200	M9
	Cromemco	£900	B5
	North Star Horizon	£900	B5
	Philips P2000	£950	P4
Solicitor's complete record accounting	Apple II	£3000	S2
Solicitor's package	Act Sirius I	£1400	S1
	CBM/8032	£1400	S1
	Compucorp	£2000	Q1
	CP/M	£1250	M5
	CP/M	£750	M6
	Sorcerer	£3500	L2
	Superbrain	£1400	S1
Statistics	Apple II	£150	G3
	Apple II	£100-195	P2
	Apple II	£140	C8
	Tandy Model I	£45	S2
Stock control/ recording	Altos (CP/M, MP/M)	£300	B1
	Act Sirius I	£265	O1
	Act Sirius I	£195	A1
	AppleII	POR	A2
	Apple II	POR	K2
	Apple II	POR	S5
	Apple II	£150	G3
	Apple II	£80	S2
	Apple II	£75/300	P2
	Apple II	£285	V1
	Apple II	£300	P1
	Apple II	£500	S4
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£175	P3
	CBM/8032	£199	T5
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£750-1500	C4
	CP/M	£350	G1
	CP/M	£900	M3
	CP/M	£700	B5
	CP/M	£550	B5
	CP/M	£550	B3
	CP/M	£300	W1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£500	G4
	CP/M	£400	M9
	Cromemco	£700	B5
	Famos	£1500	M2
	MZ-80K	£150	P2
	North Star Horizon	£450	B3
	North Star Horizon	£900	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£195	I2
	PET/CBM	£300	B4
	PET/CBM	£15	A2
	PET/CBM	£300	B1
	PET/CBM	£150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	PET/CBM	£250	R1
	PET/CBM	£35/25	H3
	PET/CBM	£199	T5
	Philips P2000	£300	P4
	Sharp PC3201	£300	P2
	Sorcerer	£390	L2
	Superbrain	£900	M3
	Superbrain	£300	S6
	Superbrain	£450	T3
	Tandy Model I	£30-50	M1
	Tandy Model II	£300	M1
	Tandy Model I	£48	S2
	Tandy Model I	£200	H1
	Tandy Model I	£115	J1
	Tandy Model I	£200	T1
	Tandy Model I	£375	T1
	Tandy Model II	£265	O1
	8080/Z80	£275	G3
	8080/Z80	£325	L1
Survey analysis	CP/M	£645	M6
Surveying	CP/M	£500	T4
TAP business system	PET/CBM	£125	H2
Text file librarian	Apple II	£125	S4
Time/cost recording	Act Sirius 1	£800	S1
	Apple II	£450	S2
	Apple II	£300	P1
	CBM/8032	£800	S1
	CP/M	£400	G1
	CP/M	£200	M3
	CP/M	£350	B3
	CP/M	POR	G4
	CP/M	£750	M6
	CP/M	POR	W4
	North Star Horizon	£250	B3
	North Star Horizon	£200	M3
	North Star Horizon	£450	W1
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B1
	Philips P2000	£300	P4
	Superbrain	£200	M3
	Superbrain	£800	S1
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Tour operators package	Sorcerer	£2900	L2
Travel agency accts	Superbrain	£800	S6
Typing tutor	CP/M	£50-125	A5
Utilities	Apple II	£40	P2
	Apple II	£20	C6
	CP/M	£50	B5
	ITT 2020	£20	C6
Utility set	PET/CBM	£78	H3
Various engineering	Tektronix		E1
Various thermal insulation industry systems	CP/M	£2000+	T6
VAT master	PET/CBM	£25	H3
VAT register	Tandy Model I	£15	H1
Video hire system	Act Sirius I	£125	C7
	CP/M	£499	G4
	Tandy Model III	£460	A4
Video message	Apple	£200	G3
Warehousing	CBM/8032	POR	S1
	CBM/8032	£375	P3
Word processing	ACT 800	£375	H4
	Act Sirius I	£295-325	A1
	Act Sirius I	£295+	O1
	Apple II	£60	S2
	Apple II	£75	K2
	Apple II	£75	S5
	Apple II	£75	A2
	Apple II	£150-300	P2
	Apple II	£75	J1
	Apple II	£120	V1
	Apple II	£180/95	S4
	Apple II	£30	C8
	Apple II	£500	T2
	Apple II	£99	T5
	CP/M	£260	C4
	CP/M	£400	G1
	CP/M	£250	M3
	CP/M	£250	B6
	CP/M	POR	B7
	CP/M	£99	T5
	CP/M	£420	V2
	Famos	£500	M2
	North Star Horizon	£250	M3
	PET	£85/65/40/20	H2
	PET/CBM	£375	H4
	PET/CBM	£325	C5
	PET/CBM	£75/150	C2
	PET/CBM	£75/150	J1
	PET/CBM	£75/150	G2
	PET/CBM	£35	H3
	Philips P2000	£230	P4
	Superbrain	£250	M3
	Tandy Model I	£50/75	M1
	Tandy Model II	£175-240	M1
	Tandy Model I	£30/60/90	S2
	Tandy Model I	£45/95	J1
	Tandy Model I	£15	H1
	Tandy Model II	£295+	O1
	Vector	£400	C5
	8000 Series	£250	C2
Work In Progress	CP/M	£850	B5

MACHINES

Machine	Application	Price	Code
ACT 800	Database management/ Word processing	£225 £375	H4 H4
Act Sirius 1	Appointments planner	£115	C7

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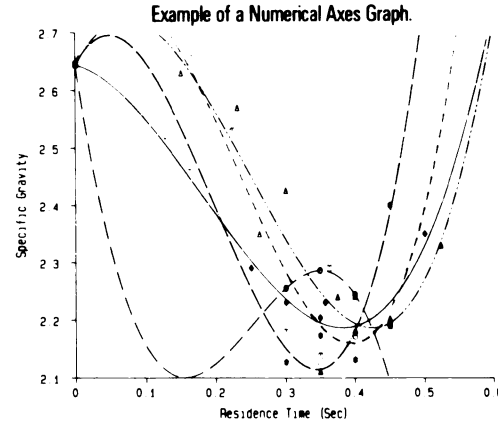
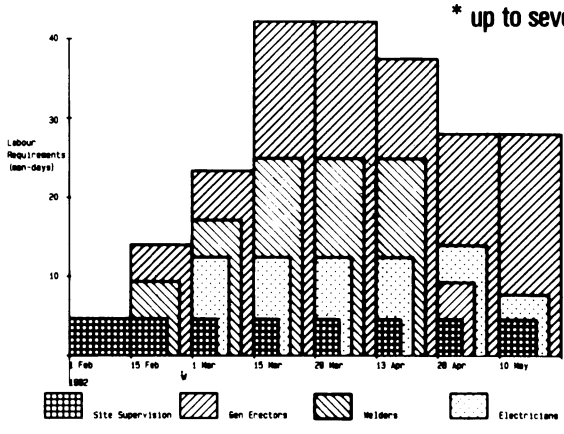
A comprehensive GRAPH configuration

* axes may be user defined or automatically fixed
* data points may be defined or suppressed
* straight joining lines or curves, the latter from complex calculations automatically executed
* up to eight colours available
* up to seven broken line patterns

Example of a Numerical Axes Graph.





A correctly proportioned HISTOGRAM configuration

* operates like GRAPH but structures in **block** format
* various shading patterns available

A quickly drawn PIE configuration

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* segments can be shown withdrawn
* various shading patterns offered
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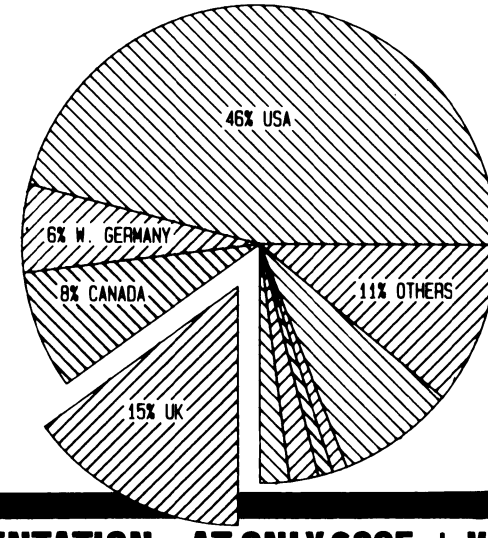

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PACKAGES

Machine	Application	Price	Code
	Financial modelling	£595	A1
	Financial planning	£150	A1
	Incomplete records	£1200	S1
	Inn Management	£185	C7
	Insurance Broker	£450	C7
	Integrated Accts	£495	A1
	Integrated Accts	£795	O1
	Invoicing	£95	C7
	Invoicing	£265	O1
	Invoicing	£195	A1
	Job Costing	£350	C7
	Job Costing	£265	O1
	Mailing list	£95	A1
	Motor Dealer	£345	C7
	Payroll	£300+	O1
	Payroll	£195	A1
	Project Management	£245	C7
	Purchase ledger	£395	A1
	Quotation Estimating	£125	C7
	Recruitment agency	£345	C7
	Sales Ledger	£395	A1
	Solicitors package	£1400	S1
	Stock control/recording	£265	O1
	Stock control/recording	£195	A1
	Time/cost recording	£800	S1
	Video hire system	£125	C7
	Word processing	£295/325	A1
	Word processing	£295+	O1
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple II	Appointments planner	£300	A6
	Bill of materials	£199	T5
	Budgeting	£125	T2
	Building estimating	£570	S8
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash flow	£100	C8
	Construction cashflow	£75	S8
	Construction expenditure	£250	S8
	Construction financial control	£750	S8
	Construction valuations	£500	S8
	Contract costing	£450	P1
	Database management/information retrieval	£150	K2
	Database management/information retrieval	£150	A2
	Database management/information retrieval	£60-140	S2
	Database management/information retrieval	£150	S5
	Database management/information retrieval	£98	P2
	Database management/information retrieval	£100	S4
	Database management	£75	P2
	Database management	£100	C8
	Database management	£125	T2
	Dental laboratory	£280	A6
	Dental records	£395	M4
	Dental records	£1700	A6
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	Estate agent	£750	S4
	Estate agent	£130	C8
	Financial modelling	£360	C8
	Financial planning	£250	S4
	General ledger/NL	£300	K2
	General ledger/NL	£300	A2
	General ledger/N/L	£450	P2
	General ledger/NL	£300	S5
	General ledger/NL	£225	V1
	General ledger/NL	£295	C6
	General ledger/NL	£250P	S4
	General ledger/NL	£600	T2
	General ledger/NL	£490	L4
	General ledger/NL	£199	T5
	Greyhound race program	£750	M6
	Hotel management	£525	M4
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Incomplete records	£450	P1
	Incomplete records	£450	P2
	Incomplete records	£490	L4
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Integrated accts	£885	V1
	Integrated accts	£450	P1
	Integrated accts	£300	P2
	Integrated accts	£600	T2
	Integrated accts	£300	W2
	Integrated accts	£1470	L4
	Integrated accts	£199	T5
	Invoicing	£295	S2
	Invoicing	£300	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£300	T2
	Invoicing	£199	T5
	Job costing	£450	S2
	Job costing	£990	X1
	Job costing	£300	P1
	Job costing	£199	T5
	Letter writer	£99	T5
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£40	P2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mailing list	£100	S4
	Mailing List	£25	T2
	Mail shot	£14	S2
	Mail shot	£225	P2
	Mail shot	£99	T5
	NEDO price adjustment	£200	S8
	Order entry/invoicing	£99	T5
	Order Processing	£99	T5
	Pad to plotter system	£250	P2
	Pad to plotter system	£180	C8
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£250P	S4
	Payroll	£400	T2
	Payroll	£490	L4
	Payroll	£199	T5
	Personal records	£75	P2
	Postal advertising response package	£350	S2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£300	K2
	Purchase ledger	£300	P2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£295	C6
	Purchase ledger	£250P	S4
	Purchase ledger	£300	T2
	Purchase ledger	£490	L4
	Purchase ledger	£199	T5
	Quotation estimating	£300	P1
	Reinforcement bar schedule	£150	S8
	Resource optimiser	£295	C10
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Sales ledger	£300	P2
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£295	C6
	Sales ledger	£250P	S4
	Sales ledger	£300	T2
	Sales ledger	£490	L4
	Sales ledger	£199	T5
	SL, PL stock control	£1000	T2
	Solicitor's complete record accounting	£3000	S2
	Statistics	£150	G3
	Statistics	£100/195	P2
	Statistics	£100-195	P2
	Statistics	£140	C8
	Stock control/recording	£150	G3
	Stock control/recording	POR	K2
	Stock control/recording	£300	P2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£500	S4
	Stock control/recording	£490	L4
	Stock control/recording	£199	T5
	Text file librarian	£125	S4
	Time/cost recording	£450	S2
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£300	P2
	Word processing	£75	S5
	Word processing	£120	V1
	Word processing	£75	J1
	Word processing	£180/95	S4
	Word processing	£30	C8
	Word processing	£500	T2
	Word processing	£99	T5
CBM/8032	Cheque writer	£90	P3
	General ledger/NL	£450	C11
	General ledger/NL	£350	W3
	General purpose transaction proc.	£495	S3
	Incomplete records	£150	W3
	Insurance renewals	£1200	S3
	Integrated accts	£1500	P3
	Integrated accts	£900	C11
	Job costing	£1000	C11
	Job costing	£350	W3
	Mailing list	£350	W3
	Motor trader	£950+	P3
	Order entry/invoicing	£750	P3
	Payroll	£375	P3
	Payroll	£350	W3
	Production control	£650+	P3
	Purchase ledger	£500	C11
	Purchase ledger	£350	W3
	Sales ledger	£500	C11
	Sales ledger	£350	W3
	Solicitors package	£140	S1
	Stock control/recording	£175	P3
	Stock control/recording	£250	C11
	Stock control/recording	£350	W3
	Time/cost recording	£800	S1
	Warehousing	£375	P3
Compucorp	Solicitors package	£2000	Q1
Challenger	Appointment Planner	£25	C7
	Invoicing	£25	C7
	Mail Shot	£25	C7
	Payroll	£25	C7
	Purchase Ledger	£25	C7
	Sales Ledger	£25	C7
	Stock Control	£25	C7
CP/M	Appointments planner	POR	G4
	Arable recording & costing	£1500	C4
	Architects package	£990	M6
	Auction package	£700	M6
	Bill of materials	£500	B5
	Bill of materials	£199	T5
	Bill of materials	£400	G4
	Bill of materials	£850	V2
	Bookmakers package	POR	B7
	Budgeting package	£95	B5
	Bursar Package	POR	M8
	Cash flow	£250	L3
	Cash flow	£95	B5
	Cash register	£300	T4
	Company secretary	£650	C4
	Container accounting	£750	M5
	Contract costing	£2000	L3
	Credit control	POR	G4
	Customer file	£900	G4
	Dairy management	£1500+	C4
	Database	£350	B3
	Database management/information retrieval	£450	C4
	Database management/information retrieval	£100	G3
	Database management/information retrieval	£400	C3
	Database management/information retrieval	£600	G5
	Database management/information retrieval	£225-485	S9
	Database management/information retrieval	£450	V2
	Debt collection	£550	G4
	Dental records	£500	T4
	Double glazing costing	£1500	V2
	Eire payroll system	£650	M5
	Equipment lease/rent/HP	£400	G1
	Estate agent	£700	B5
	Estate agent	£850	S9
	Farm accounts	£750	C4
	Financial & arable management	£220	
	Financial modelling	£400	G1
	Financial modelling	£95	B5
	Financial modelling	£400	B6
	Financial modelling	£400	V2
	Financial planning	£245	G4
	General ledger/NL	£500	L3
	General ledger/NL	£400	G1
	General ledger/NL	£375	L1
	General ledger/NL	£200	B5
	General ledger/NL	£275	S7
	General ledger/NL	£400	M3
	General ledger/NL	£350	B3
	General ledger/NL	£300	W1
	General ledger/NL	£425	B6
	General ledger/NL	£500	T4
	General ledger/NL	£400	M5
	General ledger/NL	POR	B7
	General ledger/NL	£199	T5
	General ledger/NL	£400	M9
	General ledger/NL	£950--1250	V2
	Hotel management	£525	M4
	Incomplete Records	£250	B5
	Incomplete Records	£750	M3
	Incomplete Records	£975	B3
	Incomplete Records	£750	W1
	Incomplete Records	1250	M5
	Incomplete Records	£155	C10
	Incomplete Records	£400	G4
	Industrial cleaner package	POR	B7
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Insurance brokers	£995	W1
	Insurance broker	POR	G4
	Integrated accts	£750	C4
	Integrated accts	£1100	G1
	Integrated accts	£950	L1
	Integrated accts	£690	B5
	Integrated accts	£850	S7
	Integrated accts	£990	M3
	Integrated accts	£900	B5
	Integrated accts	£1450	B3
	Integrated accts	£1200	B6
	Integrated accts	£199	T5
	Integrated accts	£3400	M9
	Invoicing	£325	L1
	Invoicing	£150	S7
	Invoicing	£250	M3
	Invoicing	£100	B5
	Invoicing	£200	B3
	Invoicing	£300	W1
	Inovicing	POR	B7
	Invoicing	£199	T5
	Invoicing	£400	M9
	Invoicing	POR	W4
	Invoicing	£400	G4
	Jewellers System	£1000	S7
	Jewellers System	POR	G4
	Job costing	£990	X1
	Job costing	£350	M3
	Job costing	£500	T4
	Job costing	£650	M5
	Job costing	POR	B7
	Job costing	£199	T5
	Job costing	£1500	T5
	Job costing	£1500	V2
	Legal precedents	£1150	C4
	Letter writer	£150	M3
	Letter writer	£99	T5
	Letter writer	POR	G4
	Magazine subscriptions	£950	S9
	Mailing list	£450	C4
	Mailing list	£250	G1
	Mailing list	£75	S7
	Mailing list	£75	S9
	Mailing list	POR	G4
	Mail shot	£450	G4

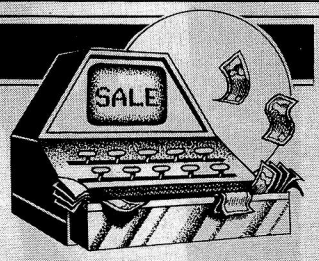
PACKAGES

Machine	Application	Price	Code
	Mail shot	£90	M3
	Mail shot	£50/150	G5
	Mail shot	£99	T5
	Membership accounting	POR	G4
	Motor dealer	POR	G4
	Order entry/invoicing	£350	G1
	Order entry/invoicing	£500	T4
	Order entry/invoicing	£550	M5
	Order entry/invoicing	POR	B7
	Order entry/invoicing	£99	T5
	Order entry/invoicing	£400	M9
	Order processing	£550	L1
	Order processing	£99	T5
	Order processing	£400	M9
	Order processing	£500	G4
	Payroll	£450	L3
	Payroll	£450	C4
	Payroll	£500	G1
	Payroll	£475	L1
	Payroll	£500	B5
	Payroll	£390	M3
	Payroll	£450	B3
	Payroll	Lease	W1
	Payroll	£425	B6
	Payroll	£500	T4
	Payroll	£450	M5
	Payroll	POR	B7
	Payroll	£199	T5
	Payroll	£600	M9
	Payroll	POR	W4
	Payroll	£395	G4
	Perpetual Inventory	£150	B5
	Personnel records	£450	C4
	Pig management	£1250	C4
	Point of sale	£400	M9
	Production control	£2400	V2
	Property management	£750-1250	C4
	Property management	£400	M3
	Property management	POR	B7
	Publishers system	£1850	S7
	Purchase ledger	£500	L3
	Purchase ledger	£450	G1
	Purchase ledger	£425	L1
	Purchase ledger	£200	B5
	Purchase ledger	£275	S7
	Purchase ledger	£400	M3
	Purchase ledger	£350	B3
	Purchase ledger	£300	W1
	Purchase ledger	£425	B6
	Purchase ledger	£500	T4
	Purchase ledger	£400	M5
	Purchase ledger	POR	B7
	Purchase ledger	£400	M9
	Purchase ledger	POR	W4
	Purchase ledger	£400	G4
	Purchase ledger	£950-1250	V2
	Quotation estimating	POR	G4
	Report generator	POR	G4
	Requirements planning	£700	V2
	Sales ledger	£500	L3
	Sales ledger	£450	G1
	Sales ledger	£425	L1
	Sales ledger	£200	B5
	Sales ledger	£275	S7
	Sales ledger	£400	M3
	Sales ledger	£350	B3
	Sales ledger	£300	W1
	Sales ledger	£425	B6
	Sales ledger	£500	T4
	Sales ledger	£400	M5
	Sales ledger	POR	B7
	Sales ledger	£199	T5
	Sales ledger	£400	M9
	Sales ledger	POR	W4
	Sales ledger	£400	G4
	Sales ledger	£950-1250	V2
	Solicitors	£1250	M5
	S/L, P/L + stock control	£1000	L3
	S/L, P/L + stock control	£900	B5
	S/L, P/L + stock control	£1200	M9
	S/L, P/L + stock control	£500	G4
	Stock control/recording	£325	L1
	Stock control/recording	£750-1500	C4
	Stock control/recording	£350	G1
	Stock control/recording	£500	B5
	Stock control/recording	£900	M3
	Stock control/recording	POR	B7
	Stock control/recording	£500	G4
	Stock control	£550	B3
	Stock control	£300	W1
	Stock control	£500	T4
	Stock control	£550	M5
	Stock control	£199	T5
	Stock control	£400	M9
	Survey analysis	£645	M6
	Surveying	£500	T4
	Time/cost recording	£400	G1
	Time/cost recording	£200	M3
	Time/cost recording	POR	W4
	Time/cost recording	POR	G4
	Time/cost recording	£750	M6
	Time ledger	£350	B3
	Typing tutor	£50-125	A5
	Utilities	£50	B5
	Various thermal insullation industry systems	£2000+	T6
	Video hire system	£499	G4
	Word processing	£400	G1
	Word processing	£260	C4
	Word processing	£250	M3
	Word processing	£250	B6
	Word processing	POR	B7
	Word processing	£99	T5
	Word processing	£420	
	Work in progress	£850	B5
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
MCZ Zilog	Mail shot	£250	I1
	Membership accting	£250	I1
	Personnel records	£400	I1
MZ-80K	Estate agent	£195	W1
	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Budgeting package	£95	B5
	Cash flow	£95	B5
	Database management/ information retrieval	£250	B3
	Double glazing costing	£750	W1
	Estate agent	£750	B5
	Financial modelling	£95	B5
	General ledger/NL	£250	B3
	General ledger/NL	£400	M3
	General ledger/NL	£400	B5
	Incomplete records	£750	M3
	Incomplete records	£250	B5
	Incomplete records	£975	B3
	Integrated accts	£950	B3
	Integrated accts	£990	M3
	Integrated accts	£690	B5
	Integrated accts	£900	B5
	Invoicing	£100	B3
	Invoicing	£250	M3
	Invoicing	£100	B5
	Job costing	£350	M3
	Letter writer	£150	M3
	Miling List	£195	W1
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Payroll	Lease	W1
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Purchase ledger	£400	B5
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Sales ledger	£400	B5
	SL, PL + stock control	£900	B5
	Stock control/recording	£450	B3
	Stock control/recordng	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Time/cost recording	£450	W1
	Word processing	£250	M3
PCC 2000 Simpelec Triton 3	Estate Agent	£350	B2
	General ledger/NL	£350	B2
	Mail Shot	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	B2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET/CBM	Assembler dev	£50	C2
	Bill of materials	£199	T5
	Bureau de change	£8	H3
	Cheque writer	£90	P3
	Credit control	£650	B4
	Database management/ information retrieval	£75	B1
	Database management/ information retrieval	£50/150	C2
	Database management/ information retrieval	£150	G2
	Database management/ information retrieval	£150	J1
	Database management/ information retrieval	POR	C1
	Database management/ information retrieval	£225	H4
	Database management/ information retrieval	£250	C3
	Disk operating system	£150	B1
	Estate agent	£30	H3
	File handling	£225	H4
	General ledger/NL	£200	C2
	General ledger/NL	£1000	C1
	General ledger/NL	£200	H3
	General ledger/NL	£199	T5
	Housing association package	POR	M7
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Integrated accts	£300	B1
	Integrated accts	£(50)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Integrated accts	£800	S3
	Integrated accts	£199	T5
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Invoicing	£400	C1
	Invoicing	£199	T5
	Job costing	£750	X1
	Job costing	£199	T5
	Lotteries	£45	H2
	Mailing list	£75	B1
	Mailing list	£45	H2
	Mailing list	£35	H3
	Membership accting	£85	H2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Payroll	£50/195	
		195	I2
	Payroll	POR	C1
	Payroll	£200/350	C5
	Payroll	£10	H3
	Payroll	£199	T5
	Personnel recors	£85	H2
	Petsoft programs	£160	J1
	Petaid report generator	£250	S3
	Prise lister	£12	H3
	Production analysis	£300	B1
	Production control	£650+	P3
	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Purchase ledger	£350	H3
	Purchase ledger	£199	T5
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£350	H3
	Sales ledger	£199	T5
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Stock control/recording	£195	I2
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	Stock control/recording	£35/25	H3
	Stock control	£199	T5
	TAP business system	£125	H2
	Time/cost recording	£300	B1
	Utility set	£78	H3
	VAT master	£25	H3
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
	Word processing	£85/65	
		£40/20	H2
	Word processing	£375	H4
	Word processing	£325	C5
	Word processing	£35	H3
PET/ Computhink	Stock control/recording	£250	R1
Philips P200	Analysis ledger	£100	P4
	Expense Analysis	£150	P4
	General ledger/NL	£100	P4
	Hotel billing	£500	P4
	Incomplete records	£150	P4
	Integrated accts	£650	P4
	Invoicing	£150	P4
	Job costing	£400	P4
	Order processing	£200	P4
	Payroll	£300	P4
	Purchase ledger	£200	P4
	Quotation estimating	£400	P4
	Renewals ledger	£200	P4
	Sales ledger	£200	P4
	S/L, P/L stock control	P4	
	Time/cost recording	£300	P4
	Word processing	£230	P4
RAIR Black Box	Financial modelling	POR	A3
	Hotel management	POR	A3
	Local government housing maint.	POR	A3
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Bookshop stock control	£1450	L2
	Car showroom sales	£1900	L2
	Department store order program	£2500	L2
	Health authority PPM	£2500	L2
	Instrument logging	£500	L2
	Invoices	£290	L2
	Mailing list	£290	L2
	Payroll	£250	L2
	Purchase Ledger	£490	
	Sales ledger	£490	L2
	Solicitors package	£3500	L2
	Stock control/recording	£390	L2
	Tour operators package	£2900	L2
Superbrain	Bill of materials	£450	T3
	Database	£300	S6
	Estate agent	£800	S6
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Incomplete Records	£1200	S1
	Integrated accts	£1200	S6
	Integrated accts	£990	M3
	Integrated accts	£1000	T3
	Integrated accts	£1200	S1
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mailing list	£140	C9
	Mail shot	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Payroll	£250+	T3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Solicitors package	£1400	S1
	Stock control	£300	S6
	Stock control	£900	M3
	Stock control	£450	T3
	Time/cost recording	£800	S1
	Time recording	£200	M3
	Word processing	£250	M3
	Travel agency accts	£800	S6
Tandy Model I	Database management/ information retrieval	£25-80	M1
	Database management/ information retrieval	£270	A4

PACKAGES

Machine	Application	Price	Code
	Database management/ information retrieval	£60	S2
	Database management/ information retrieval	£32.50	H1
	Database management/ information retrieval	£150	J1
	General ledger/NL	£90	M1
	General ledger/NL	£90	M1
	General ledger/NL	£225	H1
	General ledger/NL	£225/325	T1
	General ledger/NL	£425	T1
	Incomplete records	£40	M1
	Incomplete records	£40	H1
	Invoicing	£90	M1
	Invoicing	£280	A4
	Invoicing	£90	M1
	Invoicing	£75	T1
	Invoicing	£125	T1
	Invoicing	£265	O1
	Integrated accts	£350	M1
	Integrated accts	£550	A4
	Integrated accts	£350	M1
	Integrated accts	£75	J1
	Integrated accts	£795	O1
	Investment portfolio	£20	S2
	Invoicing	£25	H1
	Job costing	POR	M1
	Job costing	POR	M1
	Job costing	£265	O1
	Mailing list	£40	M1
	Mailing list	£75	M1
	Mailing list	£25/38/ 55	H1
	Mailing list	£50-150	S2
	Mail shot	£75+	G4
	Mail shot	£160	A1
	Mail shot	£75	M1
	Mail shot	£75+	G4
	Payroll	£249	M1
	Payroll	£200	H1
	Payroll	£218	T1
	Payroll	£375	T1
	Payroll	£300+	O1
	Purchase ledger	£90	M1
	Purchase ledger	£90	M1
	Purchase ledger	£225	H1
	Purchase ledger	£375	T1
	Purchase ledger	£375	T1
	Sales ledger	£90	M1
	Sales ledger	£90	M1
	Sales ledger	£225	H1
	Sales ledger	£225	T1
	Sales ledger	£375	T1
	Statistics	£45	S2
	Stock control/recording	£30-50	M1
	Stock control/recording	£300	M1
	Stock control/recording	£200	H1
	Stock control/recording	£48	S2
	Stock control/recording	£115	J1
	Stock control/recording	£200	T1
	Stock control/recording	£375	T1
	Stock control/recording	£265	O1
	Time/cost recording	POR	M1
	Time/cost recording	POR	M1
	VAT register	£15	H1
	Video hire system	£460	A4
	Word processing	£50/75	M1
	Word processing	£175-240	M1
	Word processing	£45/95	J1
	Word processing	£15	H1
	Word processing	£30/60/ 90	S2
	Word procesing	£295+	O1
Vector	General ledger/NL	£400	C5
	Integrated accts	£1000	C5
	Purchase ledger	£400	C5
	Sales ledger	£400	C5
	Word processing	£40	C5
8000 Series	Database management/ information retrieval	POR	C2
	Integrated accts	POR	C2
	Payroll	£250	C2
	Purchase ledger	£250	C2
	Sales ledger	£250	C2
	Word processing	£250	C2
8080/Z80	General ledger/NL	£275	G3
	General ledger/NL	£375	L1
	Integrated accts	£950	L1
	Integrated accts	£995	G3
	Invoicing	£325	L1
	Job order control	£257	G3
	Order processing	£550	L1
	Payroll	£475	L1
	Payroll	£275	G3
	Prof appts groups	£275	G3
	Prof appts individ	£220	G3
	Prof client billing	£330	G3
	Purchase ledger	£425	L1
	Purchase ledger	£275	G3
	Sales ledger	£275	G3
	Sales ledger	£425	L1
	Stock control/recording	£325	L1
	Stock control/recording	£275	G3

TRANSACTION FILE



Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for cooperating.

● UK101 — 8k RAM cased 1-2 MHz new monitor, tape disassembler + manual, books, tapes £90 ono Tel Pete on 01-445 1282 eve.

● Apple II 48k with disc drive, intriger card, super colour card and Sony colour monitor. 15 discs many programs, Word Processor, Chess Ace, Music, Glight Simulator etc £895 Nottingham 0602 872327.

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● Currah Digital cassette recorder, 6000 baud specification, under full software ontrol, suit any 6502 micro, cased, + manual, tapes and software for Acorn ATOM. £130 Tel 0223 355957 (Cambridge)

● Acorn ATOM control universal 17k RAM eurocard gives continuous memory from 2800 to 9800 hex. £60. Wordpack ROM £20. Atomcalc ROM £25. Selectur board £10 Tel 0223 355957 (Cambridge).

● VIDEO GENIE 32k +over £120 software, tapews books etc. An expansion box containing 2 sound generators printer interface RT clock PIO etc. Must sell £320. for more details Tel Portsmouth 754048 after 6.00pm.

● Wanted Wanted Wanted. As fast as possible, used or new, ZX-Spectrum 16k RAM, pay up to £130 write soon. Stephan Triebner, Wilh Leuschner Str.25, D-6103 Griesheim Germany.

● TAS80 16k LVL 2 £190 cash few weeks old, genuine bargain no tricks. Tel Shaw 840677 ask for Paul.

● TRS-80 16k level II with L.case, CTR 80 cassette, sound, manuals, books, etc. Software includes Adventures, Arcade Games, Edtasm+ Debugger, Chess, Typing Tutor, educational. Value £550, Accept £200 ono. Tel Wakefield (0924) 364455 after 5pm.

● TRS-80 LVII 16k with lots of manuals and games including 3D adventures and talking Robotron with CTR-80 recorder and leads £200 ono G Dick 39 Relugas Road, Edinburgh. Tel 031-667 7823.

● Apple Word Processor Supertext II, true shift key, lower and upper case, Maths functions auto-linking of files. Absolutely unused. £49 ono form letter module also available. Tle 031-669 6430.

● Nascom1 32kRAM, NAS SYS3, Xtal Basic V2 in PROM, Econdgraphics, Cuts, RS232 with Xtal clock, 8910 sound generator, veroframe, keyboard cased, assorted software. £250 ono L Kellett Teignmouth 06267 5901 or via Rewtel.

● Wanted OST C4P, C4P-MF, or following boards: 540B video, 505, 542REVB, 527 (8,16 or 24k), A15. Would take delivery in UK PJ Gutenstein 17, Rte de Luxembourg, Imbringen L-6195 Tel Luxembourg 78585 after 6pm.

● Acorn ATOM, Acorn built 12k ROM 12kRAM PSU, ALI leads, operators manual and cover fo computer. Software includes Games Pack 9 and Adventure program. £145 ono. Tel Bristol (0272) 570147 after 5.45pm.

● MZ-80k programs, Scrabble, Pucman, Alien Attack, Fruit Machine, Musix Box, £5.00. House Accounts, Electric and Gas. £4.00. Send cheque +50p postage to Phelps 5, Sinclair Drive, hampton Dene, Hereford.

● PET 2001 eries. Old ROM, 8k, integralcassette. Reset switch, interrupt switch, TV RE output. Over 100 games programs and PET revealed. Only 5250 Tel: 061 439 7294 ask for Colin Bodell.

● Transam Tuscan — 48k small business system with 370k storage on built-in dual 5in standard diskette. Software includes CP/M CBasic, Pascal. Bargain offer £1000. Tel 01-992 2860.

● PET 2001 8k old ROMS manuals PET revealed. Integral cassette and monitor make this bargain at £190. Buyer collects. Rel Chelmsford 420599.

● Atari 800 16k 3 months old. Cassette recorder, 2 joysticks, Star Raiders and Missile Command cartridges. £30 worth books. Cost new £654 sell for £500 Tel (02576) 3217. After 5pm.

● 16k VIC-20 cassette recorder, Super expander Rat Race cartridge, joystick, introduction to Basic Part 2. £40 software. Cost £400+ only £300. Tel 0227 791 3486.

● Apple II Europlus 48k, single disk drive. Manuals, assorted programs including games utilities and professional database. £785. Telephone Stratford Upon Avon 298187 weekends. Wrexham 263123 office hours.

● Microtan 65, Tanex, 8k RAM, XBug5.5, professional 82 key keyboard, PSU Hex keypad 13 tug newsletters, games programs, Pixel graphics, leads, manuals, all for £150. After 5pm. 66 North Walls, Stratford.

● BBC model B unused but tested. Perfect purchaser collect for £375 only. Tel Pradid working hourse 01-701 2224 weekends 01-767 3257.

● TAS-80 Modl 48k VDU exp-int, Hi-Res graphics, cassette. Over £200 software, £50 books, All VGC total cost £1350+. WIll accept £650. Sittingbourne (Kent) 0795 76257.

● ZX81 — 16k RAM, printer all SInclair built and DK'tronics keyboard. Also Chess, Asteroids, and other games + ZX81 companion. All for £130. Tel Crewe 0270 68117 eve.

● VIDEO GENIE 16k RAM, good nick! + games tapes, Editor, Assembler + books £120 for the lot. Tel: 01-845 3516 (Northolt).

● PET 4032 14 months old, Visicalc chip & prog, toolkit manuals, cover, perfect condition £475. PET 2031 single disk drive, 12 months old perfect condition disks £300 both £735 01-440 1553.

● Acorn ATOM 12k + 12k power supply manuals, leads, + much software, games including Invaders etc. £160 ono. Also large B+W monitor for above £50. Tel 0782 515677 after 6pm.

● Complete Sharp MZ80B system 2nd graphic RAM, dual disc drives, P6 printer CPM Basic 80 Pascal DP Basic, Disc Basic. New May 1982 cost £3000+ £1500 ono would seperate. Tel High Sycombe (0494) 23786.

● Silicon office-program, security disk and manuals. Also 64k upgrade to convert 8032 to 8096. Little used, new cost £1150. Offers? Tel: Tunbridge Wells 0892 35544.

● VIDEO GENIE EG3003 new Nov 81, cables, condition as new, manuals and book, selection of software, Tank Battle, Fruit Machine, Scrambler + others £230 ono Tel Martin Harvey 09322 47783.

● Apple II + 48k 1 disk drive DOS3.3, RF Modulator. Large selection of software inc Dos toolkit, Fortran Pascal software. Quick sale required hence offers £800 01-200 6905.

● Sharp MZ-80P3 printer. Sharp I/O box, printer interface card, boxed, manuals and all cables. 2 months oldand as new. £399. Swift, Chester-Le-Street 888364 eve.

● VIDEO GENIE L2 16k RAM. Integral cassette, printer interface, trapes and books. £200 01-892 1687 or Walton on Thames 25732.

● VIDEO GENIE 16k 12in TV converted for use. All monitor leads and manuals £160+ software and books including Basic programming games and utilities all for only £280 ono Tel Kidlington 77488.

● Newbrain AD Portable Computer, with built in display. As new, with standard manual + beginners manual and tape. Excellent condition only a few months old. £230 Tel 01-641 eve.

● UK101 8k RAM. New monitor, cased (crom Compshop). £95. Tel: Redhill 67988 eve.

● Exidy Sorcerer 32k fitted 1.1 monitor + Basic ROMPAK, cassette recorder and cables. TV modulator (not fitted), tapes, tape doctor. Tutorial Basic. Rob's Breakout. Manuals £350 Tel Basildon 0268 285406 eve.

● 2 Shugart SA800 standard maount 8in drives, brand new, pair £450. S100 memory cards: CCS 16k static £75. QT 16k static £75. Both 200nS. Jaws 64k dynamic £150 01-451 0520.

● S100 cards — 8k static RAM £50 — 16k (expandable to 24k) £110 16/32k EPROM, needs attention. £45 edge connectors £1.0 each. Tel Camberley 24651 after 7pm.

● PCW and PC back issue's from start. Not a complete run, so will sell issue's singly, 50p each. TelCamberley 24651 after 7pm.

● BBC A with EPROM, Ferguson Autostop tape, Counter Recorder Users Guide, and 30 hours Basic with program teaching cassettes. Bargain £280 ono Tel Farnborough Kent 53098.

● Apple II expansion cards, as new boxed with instructions, colour card £50. Lanugage card (16k memory card) £60 with Integer Basic and Pascal. Videx 80col card £150. Bryant Cambereley (0276) 28366.

● Apple disc drive with controller £200, Anadex printer DP8000 with Apple interface £300 ono. Tel 060-65 3373 Winsford Cheshire, Not office hours, Free delivery 100 miles.

● S100 IEEE696 'JADE' 64k. Synamic RAM Board + manual. Link selectable options of 8-bit wide/74k or 16-bit wide/32k. 24-bit extended, Port or Consec. Byte addresing. £160. Tel Hitchin 0462 56248.

● PET games for sale worth £200 will accept £100 ono. Also sold separately £4 £6 (all Commodore) Tel East End 698 eve only.

● RML 380Z 20k RAM, several Basics inc 51D and TXED SIO-2 PIO/RTC board, COS3.4 Blue Box, W/Key Board, Good condition, first offer above £750 accepted Tel: 024-024 4141.

● VIC-20 C2N cassette unit, 16k RAMpack, Telly Monsters cartridge, VIC revealed, joystick, magazines and software. Bught April '82 £200 ono. Tel 01-876 9598 eve.

● VIC 20 computer + Commodore cassette recorder. Still boxed for only £140 (VAT receipt supplied). Buyer collects. Must sell tel 06286 2649 eve.

● Gemini G809/G815 disk system for Nascom 2, including CPM 2.2 and many utilities and languages. Condition as new, only £600. Tel Nigel on 024-361 4989. (with 3 month guarantee).

● Atari 400 32k. Normally £60 extra, Atari recorder, Basic cartridge, games including Star Raiders, 4 joysticks, technical manuals, magazines. Cost over £500, only £395 Tel Burgess Hill 47017.

● VIDEO GENIE EG3003 16k + Transtec green screen monitor, manuals games and software 8 months old. Hardly used. Catford London. Tel 01-291 1823 After 7pm £250 ono.

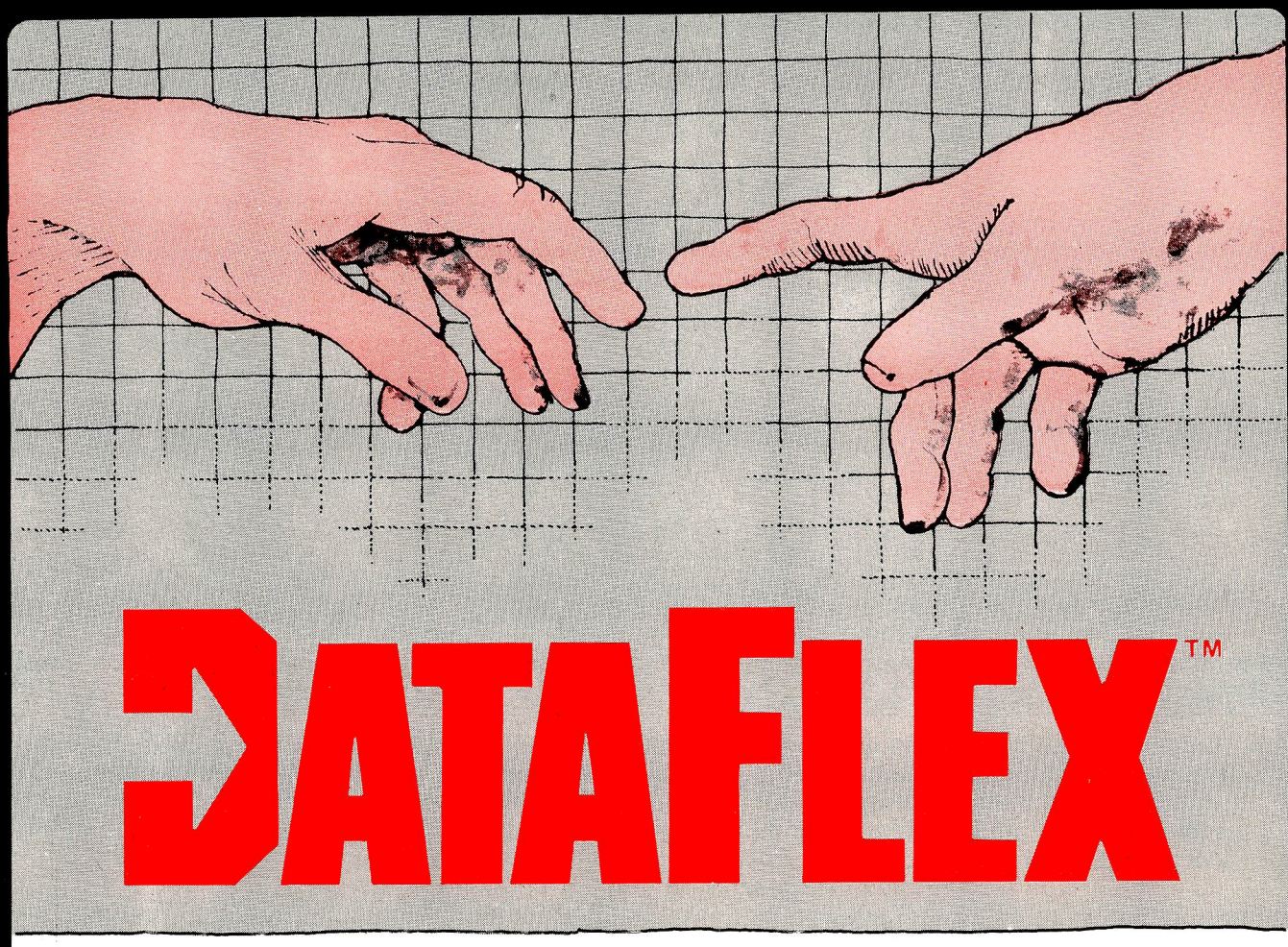
● UK101-Cegmon, cased, 8k RAM. 12k new Basic, switchable baud rates. Dissassembler and toolkits in EPROM. Full manual and lots of cassette softwae. £95 Tel Chobham (Surrey) 7298 eve.

● CBM 3040 dual floppy disk drive to DOS2.1 (4040) standard. + DISKOPRO chip. All as new £375 Danbury Essex 2615.

● Sharp PC1211 and CE122 printer cassette interface + all manuals leads etc. As new condition including cases and mains adaptor. Tel 01-802 2439 after 6.45pm, ask for Sammy Price £100.00 complete.

● VIDEO GENIE 48k with sound, fitted with tab and clear screen keys. Also included, 2 joysticks, cover, mnauals, several books, £100 of games. £300 Tel Graham Staines 62947 eves.

● VIDEO GENIE 32k LII + green screen monitor, cssette recorder, Base II printer and 200 programs + many books and



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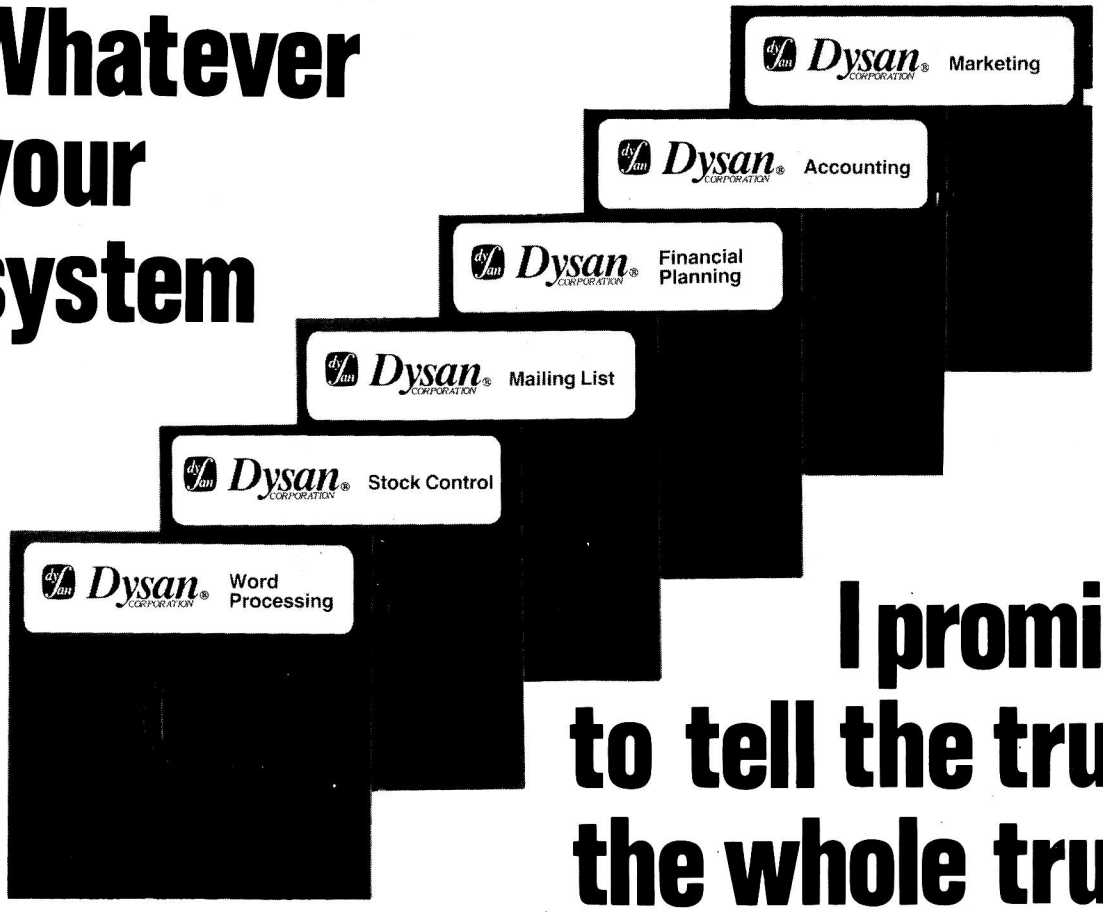

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● Acorn ATOM 8k, ROM, 4k utility ROM, 12k RAM, heavy duty PSU, leads, manual, + some software. £120 Tel Todmorden 5959.

● TRS80 48k LII, HI-RES mod, LPVII Printer, cassette, UHF modulator; All manuals, leads, covers, books, good game and utility software (Firebird, Forth, Scripsit, etc) £800. Tel 01-809 3128 eve.

● Sinclari built ZX81 excellent condition with Crofton keyboard, fitted custome case (64k RAM 5 cassettes 4 books) extension leads user magazines £140 ono Tel after 6 o'clock. Warner Brighton 0273 419854.

● Apple 2+ as new single disk, 2 controllers Silentype Printer, Hitachi monitor. Bags of software incl. DOS toolkit and many games. £1000 ono. Tel Milton Keynes (0908) 72503.

● Sharp MZ-80k 48k RAM extended Basic green screen, manual. Over £100 of software, includes Space Invaders, Scramble, Head-On Breakout and Monopoly only £325. Tel eve 061 428 9707 Manchester area.

● Acorn ATOM 12k RAM 12k ROM. Includes power supply and manuals. Also many games and leaflets including Galaxians. In excellent condition £200 Telephone 061 736 5419.

● Acorn ATOM 12k RAM 12k ROM. F/Point PSU, leads, Wordpack ROM + games and Disassembler books and magazines included £150 ono.Tel 061 653 3640 Helen.

● TRS80 LII 16k VDU + £200 of software inc Space Invaders, Asteroids, Edtasm. All leads and some micro-80 mags. Brian 01 802 9483 after 7pm. Best offer accepted.

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● CBM8032 cassette power chip. Petchess Curser tapes Supernion ect. Manuals + Osborne RS West Schematics perfect order. Home use only. £700 or very near offer. Tel anytime Folkestone 56469.

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● TI58 hardly used with American software books + all manuals etc. £40 ono. Will also throw in T157 free. Reason for selling have bought new system. Tel 579 7130 after 7pm.

● VIDEO GENIE 48k with built-in cassette-recorder. comes complete with manuals and original box. £245. London — near Parsons Green underground. Tel 01-736 3744 at weekends.

● PET/CBM 4032k computer + cassette, manuals, and software. Excellent condition, hardly used. House purchase forces sale. Consider any offers £300+ ono. Carl Oxford 54257 (work) Oxford 771608 (home).

● Spectrum 48k, boxed brand new hardly used. Software included Scramble Invaders, Gulpman, Nightflite, Hobbit, Timegate, Bomber, centipede cost 5230. Sell for £200. Guaranteed Tel Rob 440 1635 North London, postage included.

● Sharp PC3201 complete with VDU disc drive and Printer worth £2700 will accept £1590 ono. Tel 01-952 4836.

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● NASCOM II — 48k graphics, Nassys 3 steel case, room for expansion, assorted s/ware games £275 ono. Also Data Dynamics 390 printer (RS 232). Offers? Tel Yeovil 0935 27250.

● Texas silent 700, printer, keyboard, acoustic coupler, complete in professional suitcase, 10/30 CPS upper, lower case. Complete set of diagrams, needs attention hence price 5125. Tel 061 973 1487.

● Teleprinter: Data Dynamics RO390 for use iwthTandy TRS80 model I, complete with software driver, connects to cassette port. Only £90.00 Tel 0279 53952.

● ZX81+ 16k RAM over 300k of games on tape. Scramble, Invaders, 3D Defender, Gunfight, Star Trek, and many more arcade games. All worth £135. Bargain for £80. Tel Bookham Surrey 58711 eve.

● Atari 400 computer console £140. 850 Interface Module £95. Star Raiders, + joystick £23. All in as new condition. Also Dere Atari £11 no offers Welwyn Garden 07073 38338 eve.

● Acorn ATOM 12 RAM 12 ROM with £200 software Chess, Astrobirds 747 Flight etc 2 utility ROMS ATOM Magic Book, SA PSU 6522 via £220 ono 061 747 9879.

● VIC20 expansion: Stack 4-slot Motherboard and 3k RAM. £40 ono. AC Brightman, 93 East Avenue, Hayes, Midfdx UB3 2HT.

● Cesil for the BBC model B. Run your Cesil programs on your Beeb, Tape and instructions £8. V Webb, 3 Poplars Grove, Maidenhead, Berks SLE 8HD.

● BBC software, TTest program calculates statistical values for 2 sets of data. Incorporates T-Table to test level of significance. Fully documented. Cassette £5 disc £7 Andy Taylor 05097 2386 days.

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● Apple II Europlus Disk Drive, Monitor, Printer, Color Card Games, Soft Ware, Tel 01-359 2465.

● New Brain Word Processor options include save/load to tape, paged organisation, uncrashable, directory look-up all normal W/P functions, manual, cassette £5. Could pay 10 times! K. Polston. 9 Bouchier Walk, Rainham Essex.

● Atari 800 16k+ cassette, manuals, books, listings, j/stick, paddles — £435 ono or swop for BBC model B — Tel 01-393 0116 Epsom Ewell ask for Tim.

● Visicalc and Scripsit (Word Processing0 software for Tandy TRS-80 LII, including disks, manuals and audio cassettes. Cost over £200 will sell for £35 each or £60 pair. Tel: 0444 892079.

● ZX81 16k RAM Sinclair built, all leads, mains adaptor, 2 manuals, magazines, +£35 of games software. VGC. 1 yr old. £75 ono. Tel: 01-422 0764.

● Surplus, 35 boxes of 14½in computer listing papr £250. The lot. Will consider splitting into smaller lots. C Glnzebrook 0920 68585 after 8pm or w/ends.

● Compukit UK101. 7k-RAM. Many mod's 32-line screen, 600 baud, utility s/ware in EPROM. Much s/ware on cassette inc Assembler. Cassette Interface faulty when loading. offers 021 308 2909 after 6pm.

● Acorn Atom 12k + 12k, Acorn built, PSU, all leads, manual, Magic book, Life cassette, £140. Tel: 01-767 2562 (Balham)

● Aculab Tape Drive for VIDEO GENIE. Complete with extended Basic and manuals. Does not require extension interface, plugs straight into the GENIE £125.00 ono. Tel: Tim — Matlock 57151 (daytime).

● BBC A; exc cond + games gapes + 1000 pages of hints, tips, program listings. £275 ono. Genuine reason for sale. 051-342 6261.

● Tandy pocket computer and cassette interface, 6 months old, As new, boxed, all manuals, batteries, overlays and book of programs. Quick sale. £50 ono. Tel: 0494 24999 after 8pm.

● Sharp MZ-80K 48k. 12 months old, 1 yr guarantee remaining. Various games and manuals inc, will deliver within 30 miles of Slough. Must sell. £300 ono. Tel: Burnham (06286) 5981.

● VIC 20. C2N, joystick, + super expander, Sargon Chess, Avenger and Adventure Land cartridges. Vicmen, Frogger and Myriad tapes. Worth over £300, good con. will accept £230 ono. Tel-0233 3837.

● £200 will buy you a new ROM PET 32k with cassette. Rabbit and Toolkit ROMs. reset switch and £200+ of software. free! Tel- 021-360 8395, after 6pm to secure.

● VIDEO GENIE 48k. inc sound L/case + green monitor. disk drive, MX80 printer, VOX-Box, s/ware. All for £550, tel 02407 3148 eve (Bucks).

● 16k Spectrum. As new £110. Ferguson bigboard Z80 64k £200. Hitachi 9in monitor £70. Larter ASCII keyboard with casee £35. Sinclair 10MHz oscilloscope £100. Tel: Swanley 66260 eve and w/ ends.

● Microtan 65; Tanex: U/case, Graphics, ASCII keyboard, 19in rack mounted, £150. Selling in order to upgrade. Tel: 05432 52824 eve or w/ends.

● Sharp MZ80K, 20k. 1½yr old, hardly used. £150 for urgent sale, good cond. Please write C W Fung, 2 Woodlands Terrace, South Shields, Tyne and Wear NE33 2ET.

● ATOM: 64k, boxed, exc cond. programs: Invaders, Snapper, including PSU. A snip at £250. Tel: Harrogate 50379 after 6pm write: Mr Vincent 2 Dunchy Grove, Harrogate, MG2 OND, North Yorkshire

● Teleprinters Data Dynamics 390 with tape unit. RS232 interface sensible offers. Tel: 01-550 6031 Ilford, Essex.

● Commodore 32k PET Basic 4.0 + cassette deck. Only 8 months old. More than 30 games included. £550 ono. Tel: 061 740 5594 (after 6pm). Any day. Ask for Andrew.

● Sharp MZ-80K 48k. Still in box complete with Basic, manual, and Space Invaders. Mint condition. Tel: 021 422 6051 after 6pm or w/ends.

● PET 4032 large screen, manuals, books, cassette and the Amazing Arrow. All £425 ono. Tel: 01-568 6466.

● Tandy LPVI printer, US model, 110v, with dust cover, spare ribbon and some paper. parallel interface, 100CPS, paper up to 15in. Little used. £300 ono. Tel: Ascot (0990) 21510.

● Acorn ATOM 12k+12k, £100. Audio computers 64k DRAM card £35. 4-way utility ROM board with Psion, program power A+F and Eltec toolboxes £40 Tel: 01-530 6594 eve — Kneeling.

● VIC-20 with stack memory expansion (16k for Basic and 3k for machine code), Commodore cassette unit, 6 issues VIC Computing. £175 ono. Tel; Ipswich (0473)

● VIC20 6 months old with: VIC cassette unit, light pen, cassettes, books, dust cover, housing for PSU/ modulator. Hardly used £230 ono. Tel: Wargrave (Berks) 073-522 3391 anytime. Paul Briggs.

● VIDEO GENIE EG3003 C/W manuals, books, leads and £130+ software £220 ono. Tel: Colchester 230421 eve after 7pm or w/ends.

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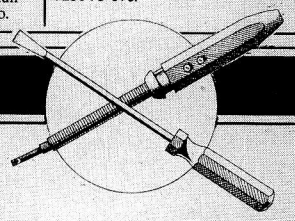
● TRS-80 L2-16k Adventure games. 2 for the price of one. Calico and Holy-Grail. Superb value £3 cassette. Send cheque to Michael Offen, 25 Sefton Park Road, Liverpool, Tel: 734 1229.
● VIC 20+ cassette deck, super expander, programmers, reference guide, joystick. Lots of programs including games and cartridges. Sell: £250 ono. Tel: Fleet 20587 (eve) Fast sale! moving onto better things.
● PET 3032 computer and 3040 disk drive. Purchased April 1982 for home educational purposes. Redundancy now forces sale. £975 ono. Tel: Keith Camberley (0276) 61484.
● Sharp MZ80K 48k complete with Basic, manual and over 40 games £300. Tel: Bradford 0274 725973 eve.

ACC NEWS



Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

It's a long time since I have mentioned the ACC itself in this column. The ACC is the national body representing computer hobbyists in the United Kingdom; it is recognised in this role by the major computer user groups in Britain, which are affiliated to the ACC.

The ACC is a democratic organisation, with an elected committee, and is non-profit-making. Its interests extend across the range of machines and manufacturers; it aims to represent the computer hobbyist movement as a whole, and therefore the ACC has links with many of the local computer clubs around the country, as well as with the national groups.

The ACC maintains a list of computer clubs around the country, which is constantly being updated from all available sources. It is considered to be the most complete list of such clubs, and inclusion on it is free. Alternatively, clubs may pay the vast sum of £2.50 a year for their nominated representative to receive the ACC's newsletter *ACCumulator.*

ACCumulator is published six times per year, and acts as an information exchange between the members. Through *ACCumulator,* the members of the ACC gain access to a breadth of experience and information not available to those who confine their interest to only one system. The articles largely reflect the subjects that are of interest to the membership, since it is they who write them. Much of the information is about DIY hardware, and recent topics include expansion of the ZX Spectrum and how to use the ZX printer as a cheap hardcopy device on other systems.

Membership of the ACC is open to individuals as well as clubs. Individual members receive *ACCumulator* by post as soon as it is published, and can help to frame ACC policy via the committee or AGM. Clubs wishing to save on the labour of producing their own newsletter might wish to consider our bulk membership scheme, whereby the members of a local club became ACC members as part of their local subscription.

Please contact me for any further information about the ACC, or if you are sure you want to join, just send me £5 (£2.50 if under 16) with your name and address (including postcode if you know it). Cheques, etc, payable to ACC.

You people out there are clearly psychic, since within days of my writing last month's ACC News, in which I complained about the lack of computer clubs in Birmingham, I received letters telling me about two clubs in the area. Mike Gibbons, of 1 New Street, Castle Bromwich, Birmingham, B36 9AP, wrote to me to mention his computer club (but what's its name, Mike?), as did Mr C J Baughan of 9 Hillman House, Smithfield Way, Conventry, CV1 1FZ. So there's a couple of leads for you if you're clubless in the Midlands. No doubt some more will appear in the response to the plea last month.

It really is time I went plugging in the Deep South. L S Fisher, of 21 Manwood Avenue, St Stephens, Canterbury CT2 7AH, is ready and waiting to get something organised in the Canterbury area, if only interested people would get in contact with him.

Still going south (and west), we come to a Mr G M Dinnage, who is appealing for 'micro enthusiasts' and 'computer game hobbyists' to come forward and join him in a Hove Club. His address is 16 Malvern Street, Hove, BN3 3YR.

All of which leads on to the teeming metropolis of Bournemouth. Two computing organisations have come to my notice from this city of dreams. One calls itself, alliteratively, the 'Bournemouth BBC Users Group'. The contact is Norman Carey, who lives at 26 Felton Road, Parkstone, Poole, Dorset. The group meets on the first and fourth Wednesday of each month from 7.30 to 10.30 in Lansdowne Computer Centre, 5 Holdenhurst Road, Bournemouth.

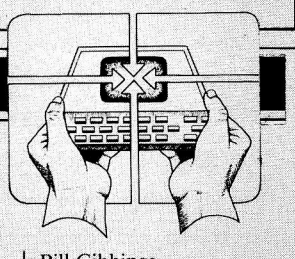
Just down the road in Charminster, Bob Green is launching his Proton Acceleration, which is a user group for anything which isn't Z80. The newsletter will be called *Accelerator* and will contain all sorts of hardware ideas and access to a software library. I hope that he's not trying to copy an amateur organisation with a similar sounding name to its newsletter, and that he will make lots of money with his new venture. Anyway, write to Proton Acceleration Limited, 16 Iddesleigh Road, Charminster, Bournemouth, Dorset if you want to know how Bob's BBC/PET/Apple/Acorn/Microtan group is going.

Many important computer shows are being covered again this year by the ACC. Secretaries who would like space at the following should get in touch with the ACC Secretary as soon as possible — David Annal, 142 Windermere Road, London SE16 5HE. Tel: (01) 764 4043. Scottish *PCW* Show, Ingliston, Edinburgh, 16-18 April; Midland Computer Fair, Birmingham, 28-30 April; The Computer Fair, Earls Court London, 16-19 June; *PCW* Show, Barbican, London 28 Sept-2 Oct. And don't forget to come to the Association of London Computer Clubs' own fair at Central Hall, Westminster on 14-16 April. See you there!

And finally, I should mention that the much heralded and delayed Newbrain now has a prospective user group. Contact Anglea Watkiss, 4 Ninnings Lane, Rabley Heath, Welwyn, Herts AL6 9TD or telephone Stevenage (0438) 812439 if you're interested in a national Newbrain user group.

For more information on the ACC, contact: Rupert Steele, St John's College, Oxford, OX1 3JP. Tel Oxford (0865) 512811.

CTUK! CONTACTS



*For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #*

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NG16 3BJ

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ) Tel: 0482 859169, System operator: Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm tp 10.00pm.

Forum-80 London ... Tel: 01-747 3191. System operator: Leon Jay. Electric Mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00pm.

Forum-80 Milton ... (TRS-80 Users Group 80-Nett) Tel: 0908 566660. System operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00pm.

Forum-80 Holland ... Operator: Nico Karssemeyer, Tel: 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours; Tues-Sat 1800-0700 nightly, continuous from 1800 Sat-0700 Tues.

CBBS London ... Operator: Peter Goldman, Tel: 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool ... 051-220 9733. System operator: Peter Toothill, Electronic mail, down-loading TRS-80 information.

ACC ... members bulletin board, Peter Whittle (0908 44262).

ABC-80 ... Stockholm (Sweden). Tel: 010-468 190522.

University Research Computer ... Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

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USA	(Rosemont) Computerised Office Equipment Exbn. Contact: Cahners Exposition Group, 0483 38085	5-7 April
London	(Imperial College) Engineering Software Exbn. Contact: Computational Mechanics Centre, 0703 21397	11-13 April
Chester	(Northgate Arena) Business Efficiency Exbn. Contact: Glendale Exbns, 0244 318193	1-14 April
USA	(Chicago) Information Management Exbn & Conf. Contact: Clapp & Poliak Inc, 021-384 3384	12-14 April
Guildford	(Sports Centre) Business Management Exbn. Contact: WM Exbn Management, 0703 31567	12-14 April
Newton Aycliffe	(Recreation Centre) Comtec Exbn. Contact: Sedgefield District Council, 0388 816166	13-16 April
Manchester	Computer Open Day Exbn. Contact: Couchmead Communications, 01-778 1102	14 April
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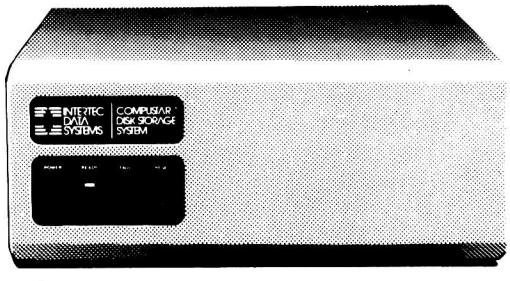

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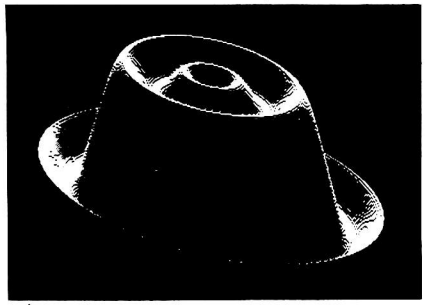

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As all programs in PCW are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in — get a friend to try it out first — and all programs we publish are paid for at a regular rate. Send contributions to: Maggie Burton PCW Programs, 62 Oxford Street, London W1A 2HG — and please enclose an SAE if you want material returned.

BBC Bigprint

by Peter Whitworth

This program will display messages on the screen using large characters. Up to 10 'pages' can be typed in and then saved on tape or disk for future display. All of the keyboard characters can be used as well as any special ones defined by the VDU 23 statement; two examples of such characters are given in the program at lines 80-110. They are used later in the program when printing out an introductory page, but note that at line 3090 the printer used could not print these special characters, the a and b shown there are actually CHR$(225) and CHR$(226) respectively. They can be obtained by pressing the function keys f0 and f1 once the keys have been enabled — up to eight other characters could be obtained in a similar way by using f2 to f9. Simple ways of generating such characters graphically and computing the VDU 23 code have been described in earlier edition of this magazine, and so will not be discussed further here.

The characters are printed using graphics Mode 5. They are four times the size of Mode 0 characters, or twice as big as Mode 7 double height teletext characters, giving a display page of 6 lines of 20 characters. The size of the text could be altered by changing the scales SX% and SY% in line 330, but it has been found by experiment that this size gives very readable displays at a considerable distance. Larger characters of eight times the normal size can be obtained more simply, but are too big to convey much information before the screen is full, and for smaller sizes teletext characters are better formed and give a clearer display. Any of the colours 0 to 7 can be chosen as a background colour and up to three different colours in the range 0 to 15 can be used to print the text; the selection can be changed for each new page. Any colour combinations can be used with a monitor, but if you are using a colour television a black background may be clearer, while the flashing colour combinations pair well together.

As the program requires you to format the 'page' before it can be translated into a large screen display, a 'mini' text editor is included in the procedure PROCPAGE starting at line 4000. Extensive use is made here of the byte indirection operator ? and the cursor control keys (enabled by the *FX 4,1 statement at line 4020) to ensure easy manipulation and correction of the text. When input of the display is complete,

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the pages and colours can be saved on tape or disk for future use, but no facilities are included for correcting the pages once stored, so check that you like the format of each page before continuing.

Bigprint needs a 32k BBC micro to run.

```
      >LIST
   10 REM BIGPRINT
   11 REM (C) P.WHITWORTH
   13 REM VERSION 2.0/JANUARY 1983
   14 :
   50 ON ERROR GOTO 180
   60 *TV255
   69 :
   70 REM*** USE f0, f1 TO PRINT THE TWO SPECIAL CHARACTERS 225,226 ***
   71 :
   80 *KEY0 "!!a"
   90 *KEY1 "!!b"
  100 VDU23,225,28,8,62,93,28,20,20,54
  110 VDU23,226,28,8,62,93,28,62,20,54
  120 DIM COL(6,10),LCOL(6,10),BACKCOL(10),P$(10),C 119
  130 MODE7:Q$=FNTITLE
  140 MODE6:VDU19,0,4,0,0,0
  150 IF Q$="Y" OR Q$="y" THEN PROCFILEIN ELSE PROCINPUT
  160 MODE5:PROCDISPLAY
  169 :
  170 REM*** ERROR TRAP, INCLUDING ESCAPE TO STOP THE PROGRAM ***
  171 :
  180 MODE7:IF ERR=17 THEN PROCDOUBLE(10,6,"Finished") ELSE REPORT:PRINT" in lin
      e ";ERL
  185 *FX4,0
  190 END
  191 :
  199 :
  200 DEF PROCLARGE(SX%,SY%,OXS%,OYS%,ST%)
  204 :
  205 REM*** DRAW EACH CHARACTER ON AN 8 BY 8 GRID ***
  206 :
  210 XS%=OXS%:YS%=OYS%
  215 FORY%=0TO7
  220   T%=?(ST%+Y%):TEST%=128
  225   FORX%=0TO7
  230     IF(TEST% AND T%)=0THEN250
  240     MOVEXS%,YS%:PLOT1,0,SY%
  250     XS%=XS%+SX%:TEST%=TEST%DIV2
  260     NEXTX%
  270   YS%=YS%-SY%:XS%=OXS%
  280   NEXTY%
  290 ENDPROC
  291 :
  299 :
  300 DEF PROCDISPLAY
  309 :
  310 REM*** TURN OFF CURSOR AND DISPLAY EACH PAGE USING GRAPHICS MODE 5 ***
  311 :
  320 VDU23;8202;0;0;0;CLG
  330 SX%=8:SY%=16
  340 FOR N=START TO NUMBER
  350   PROCCHANGECOL(N)
  360   NC=1:GCOL0,LCOL(NC,N)
  370   OXS%=0:OYS%=1000
  380   T$=P$(N)
  390   FOR LOOP=1 TO LEN(T$)
  400     TEMP=ASC(MID$(T$,LOOP,1))
  410     IF TEMP<224 THENST%=&C000+(TEMP-32)*8 ELSE ST%=&C00+(TEMP-224)*8
  420     IF TEMP=32 THEN 440
  430     PROCLARGE(SX%,SY%,OXS%,OYS%,ST%)
  440     OXS%=OXS%+8*SX%
  450     IF OXS%<1281-8*SX% THEN 480
  460     OXS%=0:OYS%=OYS%-11*SY%
  470     NC=NC+1:IF NC<7 THEN GCOL0,LCOL(NC,N)
  480     NEXT LOOP
  490   TEMP=INKEY(200)
  500   NEXT N
  510 START=1:GOTO340
  590 ENDPROC
  591 :
  599 :
  800 DEF FNTITLE
  810 PROCDOUBLE(5,6,"This Program")
  820 PROCDOUBLE(10,3,"will print a message in")
  830 PROCDOUBLE(15,2,"LARGE characters")
  840 TEMP=INKEY(500)
  850 INPUTTAB(0,20)"Do you wish to recall a filed display  (Y or N) ",Q$
  860 IF Q$<>"Y" AND Q$<>"y" AND Q$<>"N" AND Q$<>"n" THEN 850
  890 =Q$
  891 :
  899 :
 1000 DEF PROCDOUBLE(Y,C,S$)
 1009 :
 1010 REM*** PRINT CENTRED STRING USING COLOURED DOUBLE-SIZED TELETEXT CHARS ***
 1011 :
```


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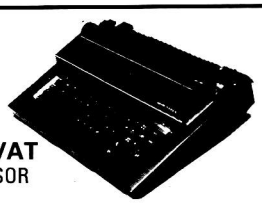

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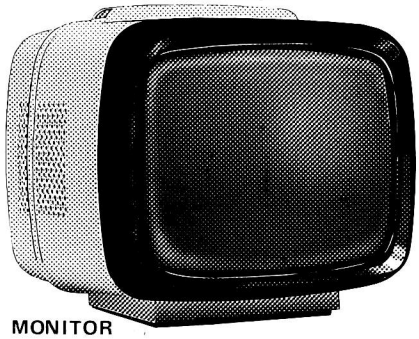

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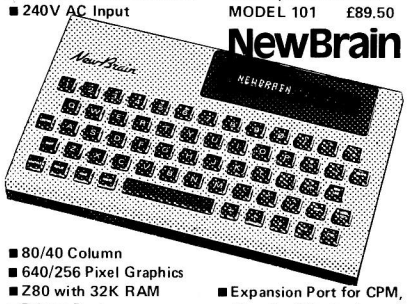

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PROGRAMS

```
1020 LOCAL I,X
1030 X=INT((36-LEN(S$))/2)
1040 FOR I=0 TO 1
1050   PRINTTAB(X,Y+I)CHR$(141)CHR$(128+C)S$
1060   NEXT I
1090 ENDPROC
1091 :
1999 :
2000 DEF PROCFILEIN
2009 :
2010 REM*** INPUT 'PAGES' AND COLOURS FROM TAPE OR DISC ***
2011 :
2020 INPUT"File name",F$
2030 F=OPENIN(F$)
2040 INPUT#F,NUMBER
2050 FOR N=1 TO NUMBER
2060   INPUT#F,P$(N)
2070   INPUT#F,BACKCOL(N)
2080   NCOL=0
2090   FOR I=1 TO 6
2100     INPUT#F,COL(I,N)
2110     PROCCHECKCOL(I,N)
2120     NEXT I
2130   NEXT N
2140 CLOSE#F
2150 START=1
2190 ENDPROC
2191 :
2499 :
2500 DEF PROCFILEOUT
2509 :
2510 REM*** SAVE 'PAGES' AND COLOURS ON TAPE OR DISC ***
2511 :
2520 INPUT"File name",F$
2530 F=OPENOUT(F$)
2540 PRINT#F,NUMBER
2550 FOR N=1 TO NUMBER
2560   PRINT#F,P$(N)
2570   PRINT#F,BACKCOL(N)
2580   FOR I=1 TO 6
2590     PRINT#F,COL(I,N)
2600     NEXT I
2610   NEXT N
2620 CLOSE#F
2690 ENDPROC
2691 :
2999 :
3000  DEF PROCINPUT
3009 :
3010 REM*** INPUT ROUTINE FOR DISPLAYS TYPED IN FROM THE KEYBOARD ***
3011 :
3020 START=0:NUMBER=0
3030 INPUT''"Please type in your name "'N$
3039 :
3040 REM*** CENTRE NAME ON LINE AND MAKE UP ZERO 'PAGE', INCLUDING TWO SPECIAL
       CHARACTERS ***
3041 :
3050 L=LEN(N$):IF L<20 THEN S=INT((20-L)/2) ELSE IF L>19 THEN S=0:L=20:N$=LEFT$
       (N$,20)
3060 N$=STRING$(S," ")+N$+STRING$(20-L-S," ")
3070 P$(0)="ababa BIGPRINT babab  This message was     typed in by :-   "+N$+ST
     RING$(20," ")+"babab BIGPRINT ababa"
3079 :
3080 REM*** SELECT COLOURS FOR INTRODUCTORY PAGE ***
3081 :
3090 FOR I=1 TO 6:COL(I,0)=3:LCOL(I,0)=1:NEXT I
3100 BACKCOL(0)=4:COL(2,0)=5:LCOL(2,0)=2:COL(3,0)=5:LCOL(3,0)=2:COL(4,0)=11:LCO
       L(4,0)=3
3109 :
3110 REM*** RETURN FOR INPUT OF THE NEXT 'PAGE' ***
3111 :
3120 FOR NUMBER=1 TO 10
3130   CLS:PRINT''"Type in your message in the space below as you would like it
       displayed on the   screen when enlarged."
3140   PRINT''"Each 'Page' consists of 6 lines of 20   characters, up to 10 page
       s can be typed in and displayed."'''"The display can then be saved on tape
       ordisc if desired."
3150   PRINTTAB(0,20)"Use the cursor control and delete keys  to help you posit
       ion the text."'''"Press RETURN only when you have finishedtyping in the who
       le page.";
3159   :
3160   REM*** SET UP SMALL WINDOW FOR THE 'PAGE' AND FILL WITH SPACES ***
3161   :
3170   VDU28,10,18,29,13:COLOUR0:COLOUR129:CLS
3180   VDU28,10,19,29,13
3190   FOR I%=0 TO 119:C?I%=32:NEXT I%
3200   PROCPAGE
3210   VDU28,0,24,39,20:COLOUR1:COLOUR128:CLS
3220   P$(NUMBER)=""
3230   FOR I%=0 TO 119:P$(NUMBER)=P$(NUMBER)+CHR$(C?I%):NEXT I%
3239   :
3240   REM*** SELECT COLOURS FOR THE PAGE ***
3241   :
3250   INPUT''"Type the number (between 0 and 7) for   the background colour to
       the page "Q$
```


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PROGRAMS

```
3260   BACKCOL(NUMBER)=FNINTEST(Q$,0,7):IF BACKCOL(NUMBER)<0 THEN 3250
3270   PRINT''"Now give the colour numbers (between 0 and 15) to be used for ea
       ch line."'"A maximum of 3 different colours can be used per 'Pase'."'"Pr
       ess RETURN after each number.";
3280   NCOL=0
3290   FOR I=1 TO 6
3300     VDU28,5,19,9,13
3310     INPUTTAB(0,I-1)Q$
3320     VDU28,0,24,39,20:CLS
3330     COL(I,NUMBER)=FNINTEST(Q$,0,15):IF COL(I,NUMBER)<0 THEN 3300
3340     PROCCHECKCOL(I,NUMBER):IFS=-1THEN 3300
3350     NEXT I
3400   INPUT''"Do you wish to type in any more 'Pases' (Y or N) ",Q$:IF Q$="N" O
       R Q$="n" THEN 3450 ELSE IF Q$<>"Y" AND Q$<>"y" THEN 3400
3420   VDU 26:CLS
3430   NEXT NUMBER
3450 INPUT"Do you want to save the display (Y or N)",Q$:IF Q$="N" OR Q$="n" THE
     N 3470 ELSE IF Q$<>"Y" AND Q$<>"y" THEN 3450
3460 PROCFILEOUT
3470 PRINT''"The display is about to start.  It will loop round printing your me
     ssage until you press ESCAPE to stop."
3480 TEMP=INKEY(800)
3490 ENDPROC
3491 :
3599 :
3600 DEF PROCCHANGECOL(P)
3609 :
3610 REM*** ASSIGN PHYSICAL COLOURS TO LOGICAL COLOUR NUMBERS ***
3611 :
3620 VDU19,0,BACKCOL(P),0,0,0
3630 GCOL0,128:CLG
3640 FORI=1TO6
3650   VDU19,LCOL(I,P),COL(I,P),0,0,0
3660   NEXTI
3690 ENDPROC
3691 :
3699 :
3700 DEF PROCCHECKCOL(I,P)
3709 :
3710 REM*** CHECK THAT NOT MORE THAN 3 COLOURS PER PAGE ARE USED ***
3711 :
3720 S=0:IF I=1 THEN 3770
3730 FORJ=1TOI-1
3740   IF COL(J,P)=COL(I,P) THEN S=1:LCOL(I,P)=LCOL(J,P)
3750   NEXT J
3760 IF S=1 THEN ENDPROC
3770 NCOL=NCOL+1:IF NCOL>3 THEN PRINT"Only 3 different colours can be used.":NC
     OL=3:S=-1:ENDPROC
3780 LCOL(I,P)=NCOL
3790 ENDPROC
3791 :
3799 :
3800 DEF FNINTEST(Q$,START,LAST)
3809 :
3810 REM*** GENERAL INPUT ROUTINE FOR NUMBERS ***
3811 :
3820 T=ASC(Q$):IF T<48 OR T>57 THEN NQ=-1:GOTO 3890
3830 T=VAL(Q$):IF T<START OR T>LAST THEN PRINT''"Type a number between ";START;"
       and ";LAST;" only.":NQ=-1 ELSE NQ=T
3890 =NQ
3891 :
4000 DEF PROCPAGE
4009 :
4010 REM*** MINI TEXT EDITOR FOR INPUT AND CORRECTION OF THE 'PAGE' ***
4011 :
4020 *FX4,1
4030 P%=0:NP%=0
4040 T%=GET
4050 IF T%=13 THEN 4900
4060 IF T%<32 THEN 4040
4070 IF T%=136 THEN S%=-1:GOTO 4500
4080 IF T%=137 THEN S%=1:GOTO 4500
4090 IF T%=138 THEN S%=20:GOTO 4500
4100 IF T%=139 THEN S%=-20:GOTO 4500
4110 IF T%=127 THEN 4600
4120 IF P%<NP% THEN 4750
4130 VDU T%:C?P%=T%
4140 IF P%<120 THEN NP%=P%
4150 P%=P%+1:S%=0
4489 :
4490 REM*** CHECK AND UPDATE P% ***
4491 :
4500 TEMP%=P%+S%
4510 IF TEMP%<0 OR TEMP%>119 THEN TEMP%=0:S%=0:VDU30
4530 P%=TEMP%:IF S%<>0 THENVDU T%-128
4550 GOTO 4040
4589 :
4590 REM*** DELETE CHARACTERS ***
4591 :
4600 IF P%=0 THEN 4040
4620 VDU8:X%=POS:Y%=VPOS
4630 FOR I%=P% TO NP%
4640   VDU C?I%:C?(I%-1)=C?I%
4650   NEXTI%
4660 VDU 32:C?NP%=32
```


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PROGRAMS

```
4670 VDU 31,X%,Y%
4680 NP%=NP%-1
4700 P%=P%-1
4710 GOTO4040
4739 :
4740 REM*** INSERT CHARACTERS ***
4741 :
4750 IF NP%=119 THEN 4040
4760 VDU T%
4770 X%=POS:Y%=VPOS
4780 T1%=C?P%:C?P%=T%
4790 FORI%=P% TO NP%
4800   VDU T1%
4810   T2%=C?(I%+1)
4820   C?(I%+1)=T1%
4830   T1%=T2%
4840   NEXT I%
4850 VDU31,X%,Y%
4860 NP%=NP%+1:P%=P%+1
4870 GOTO 4040
4889 :
4890 REM*** CHECK FOR END OF INPUT ***
4891 :
4900 X%=POS:Y%=VPOS
4910 VDU28,0,24,39,20:COLOUR1:COLOUR128:CLS
4920 INPUT''"Do you want to make any further changes to the 'Page' (Y or N) ",Q$
     :IF Q$="N" OR Q$="n" THEN 4980 ELSE IF Q$<>"Y" AND Q$<>"y" THEN 4920
4930 VDU28,10,19,29,13:COLOUR0:COLOUR129
4940 VDU31,X%,Y%:GOTO 4040
4980 *FX4,0
4990 ENDPROC
4991 :
*SPOOL
```

PART 1 : BASIC Language Program "BIGPRINT"

Program of the Month

PET Billy

by Bob Chappell

Maths teaching programs have been featured within these pages before. But this one is probably the most comprehensive we've ever had. It's for children of early primary school age. Not only does it handle addition/subtraction, but it also deals with multiplication/division.

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The graphics are clear and a wide choice of difficulty levels/types of sum combinations are possible. It would certainly come in useful in a classroom where the novelty of having a computer replace the teacher for half an hour or so could well reinforce what is learnt by the pupils.

Billy presents no complications in its use — all necessary explanations are given. It was tested on a 3000 series PET.

```
10 REM**BILLY**BOB CHAPPELL**********14/2/82*****
20 POKE59468,12:A=RND(-TI)
30 DEFFNA(X)=INT(X*RND(1)+1)
40 DEFFNB(DL)=INT((DU-DL+1)*RND(1)+DL)
50 GOSUB930
60 WT=0:GOSUB640
70 AL=LV(LV):DL=DV(LV,0):DU=DV(LV,1)
80 T=0:GOSUB520:FORJ=1TOTQ:PRINT"■"TAB(12);Q$;J"■ "
90 ONSGGOSUB140,200,260,290,320:NEXT
100 GOSUB830:PRINT"■■■■■■■■■YOU SCORED"T"OUT OF"TQ"■■."
110 GOSUB520:GOSUB520:GOSUB830:IFT=TQTHENGOSUB580:GOSUB830:GOTO60
120 GOSUB830:PRINTM0$:GOSUB520:GOSUB830:GOTO1620
130 REM**ADD
140 N3=FNA(AL)
150 N1=FNA(AL):IFN1>N3THENY=N3:N3=N1:N1=Y
160 IFN1=N3THEN150
170 N2=N3-N1:GOSUB330
180 RETURN
190 REM**SUBTRACT
200 N3=FNA(AL)
210 N1=FNA(AL):IFN1<N3THENY=N1:N1=N3:N3=Y
```


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PROGRAMS

```
220 IFN1=N3THEN210
230 N2=N1-N3:GOSUB330
240 RETURN
250 REM**MULTIPLY
260 N2=DT(FNB(DL)):N1=FNA(12):N3=N1*N2:GOSUB330
270 RETURN
280 REM**DIVIDE
290 N2=DT(FNB(DL)):N1=FNA(12)*N2:N3=N1/N2:GOSUB330
300 RETURN
310 REM**MIXED
320 SG=FNA(4):ONSGGOSUB140,200,260,290:SG=5:RETURN
330 REM**GRAPHIC NOS
340 N1$=MID$(STR$(N1),2)
350 N2$=MID$(STR$(N2),2)
360 N3$=MID$(STR$(N3),2)
370 GOSUB830:K1=11:LN=LEN(N1$):IFLN=3THENK1=6
380 FORK=1TOLN:N=VAL(MID$(N1$,K,1))
390 PRINTLEFT$(EC$,K1);N$(N);:K1=K1+6
400 IFN=1THENK1=K1-4
410 NEXT:PRINT:PRINTNC$;S$(SG);
420 K1=30:LN=LEN(N2$):IFLN=3THENK1=25
430 FORK=1TOLN:N=VAL(MID$(N2$,K,1))
440 PRINTLEFT$(EC$,K1);N$(N);:K1=K1+6
450 IFN=1THENK1=K1-4
460 NEXT:PRINT:PRINTS$(5);
470 GOSUB860:PRINTMD$:GOSUB850:IFVAL(B$)=N3THENT=T+1:PRINTRA$:GOTO510
480 PRINTWA$:GOSUB520:PRINTMD$:GOSUB850
490 WT=WT+1:WG(WT,1)=N1:WG(WT,2)=N2:WG(WT,0)=SG
500 PRINT"■"TAB(10);N1;SS$(SG);N2;"=";N3
510 GOSUB520:RETURN
520 FORK=1TOPP:NEXT:RETURN
530 PRINT"■■■■■■■■■"N1;SS$(SG);N2;"=";N3
540 PRINT"■■■■■■ PLEASE PRESS THE SPACE BAR ■■S";
550 GET A$:IFA$=""THEN550
560 IFA$<>" "THEN550
570 RETURN
580 PRINT"■■■■■■■"BP$:GOSUB520
590 FORJ=1TO40:PRINT"■■■■■■■"TAB(7)"***";TAB(27)"***"
600 PRINT"■■■■■■■■■■■■■■■■■■■■";NM$;TAB(19)"●";TAB(38-LEN(NM$));NM$:PRINTBP$
610 PRINT"■■■■■■■"TAB(7)"——";TAB(27)"——"
620 PRINT"■■■■■■■■■■■■■■■■■■■■";NM$;TAB(19)"■o■";TAB(38-LEN(NM$));NM$
630 PRINT"■";BP$:NEXT:RETURN
640 GOSUB1550
650 PRINT"■■■■■■1.  +  ADDITION
660 PRINT"■■■■■■2.  -  SUBTRACTION
670 PRINT"■■■■■■3.  ×  MULTIPLICATION
680 PRINT"■■■■■■4.  "SS$(4)"  DIVIDE
690 PRINT"■■■■■■5.     MIXED
700 PRINT"■■■■■■6.     START AGAIN
710 GOSUB1610
720 SG=VAL(B$):IFSG<1ORSG>6THEN640
730 IFSG=6THENRUN
740 GOSUB1550
750 PRINT"■■■■■■■1.  EASY
760 PRINT"■■■■■■2.  HARD
770 PRINT"■■■■■■3.  DIFFICULT
780 PRINT"■■■■■■4.  MIXED
790 GOSUB1610
800 LV=VAL(B$):IFLV<1ORLV>4THEN740
810 PRINT"■";:FORK=1TO24:PRINTF$:NEXT:PRINTNC$
820 PRINT"■■■";NM$;TAB(38-LEN(NM$));NM$:GOSUB830:RETURN
830 PRINT"■■":FORK=1TO9:PRINTE$:NEXT
840 PRINT:FORK=1TO7:PRINTNS$:NEXT:PRINT"■"S1$:PRINTS2$
850 FORK=1TO3:PRINTM$:NEXT:RETURN
860 PRINT"";:B$=""
870 GETA$:IFA$=""THEN870
880 A=ASC(A$):IF(A=13ORA=20)ANDB$=""THEN870
890 IFA=13THENPRINT:RETURN
900 IFA=20THENB$=LEFT$(B$,LEN(B$)-1):PRINT"■ ■";:GOTO870
910 IFA<48ORA>57THEN870
920 PRINTA$;:B$=B$+A$:GOTO870
930 PRINT"■";TAB(12)"■ BILLY "
940 PRINT"■■■■■Y NAME IS BILLY.":PRINT"■■PLEASE TYPE IN YOUR NAME AND
950 PRINT"■PRESS THE RETURN BUTTON.":PRINT"■IF YOU MAKE A MISTAKE,
960 PRINT"■PRESS THE DELETE BUTTON.
970 PRINT"■■■";TAB(12);:NM$=""
980 GETA$:IFA$=""THEN980
990 A=ASC(A$):IF(A=13ORA=20)ANDNM$=""THEN980
1000 IFA=13THENPRINT:NM$=LEFT$(NM$,14):GOTO1030
1010 IFA=20THENNM$=LEFT$(NM$,LEN(NM$)-1):PRINT"■ ■";:GOTO980
1020 PRINTA$;:NM$=NM$+A$:GO,J980
1030 GOSUB1550:PRINT"■■■■■■■1.  2 SECOND PAUSES
1040 PRINT"■■■■■■2.  5 SECOND PAUSES
1050 PRINT"■■■■■■3.  8 SECOND PAUSES
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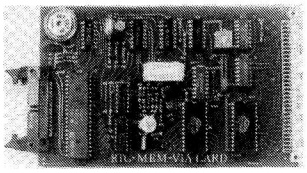

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PROGRAMS

```
1060 PRINT"4.  10 SECOND PAUSES
1070 GOSUB1610
1080 PP=VAL(B$):IFPP<1ORPP>4THEN1030
1090 PP=PP*2000
1100 GOSUB1550
1110 PRINT"1.  10 QUESTIONS
1120 PRINT"2.  20 QUESTIONS
1130 PRINT"3.  30 QUESTIONS
1140 PRINT"4.  40 QUESTIONS
1150 GOSUB1610
1160 TQ=VAL(B$):IFTQ<1ORTQ>4THEN1100
1170 TQ=TQ*10
1180 DIMN$(9),S$(5),SS$(4),DT(11),LV(4),DV(4,1),WG(40,2)
1190 FORJ=0TO9:READN$(J):NEXT
1200 N$(0)=N$(0)+"      ":N$(8)=N$(8)+"      "
!|"
1220 DATA"                 "
1230 DATA"                              "
1240 DATA"                              "
1250 DATA"                            "
1260 DATA"                              "
1270 DATA"                                "
1280 DATA"                     "
"
1300 DATA"                                              "
1310 FORJ=1TO5:READS$(J):NEXT
1320 DATA"                     ","          "
1330 DATA"                              ","                    "
1340 DATA"                                           "
1350 FORJ=1TO11:READDT(J):NEXT
1360 FORJ=1TO4:READLV(J):NEXT
1370 FORJ=1TO4:READDV(J,0),DV(J,1):NEXT
1380 DATA2,5,10,3,4,6,11,7,8,9,12,10,20,100,100,1,3,4,7,8,11,1,11
1390 FORJ=1TO4:READSS$(J):NEXT
1400 DATA+,-,"x","."
1410 EC$=""
1420 NC$=""
1430 F$="                                         "
1440 E$="                      "
1450 NS$="                       "
1460 S1$=""
1470 S2$=""
1480 M$="                                "
1490 MD$=""
1500 RA$="WELL DONE! THAT IS RIGHT.
1510 WA$="SORRY. THAT IS WRONG."
1520 MQ$="LET'S DO SOME REVISION."
1530 Q$=" QUESTION"
1540 BP$="****** I AM SO PLEASED ******":RETURN
1550 PRINT"";TAB(10)"";:FORJ=1TOLEN(NM$)+2:PRINT" ";:NEXT:PRINT
1560 PRINTTAB(10)" "NM$;" "
1570 PRINTTAB(10)"";:FORJ=1TOLEN(NM$)+2:PRINT" ";:NEXT:PRINT
1580 PRINT"PLEASE PRESS ONE OF THESE NUMBERS THEN
1590 PRINT"PRESS THE RETURN BUTTON.IF YOU MAKE "
1600 PRINT"A MISTAKE,PRESS THE DELETE BUTTON.":RETURN
1610 PRINT"WHICH NUMBER DO YOU WANT? ";:GOSUB860:RETURN
1620 REM**REVISION****
1630 FORJ1=1TOWT:N1=WG(J1,1):N2=WG(J1,2):SG=WG(J1,0):PRINT""
1640 ONWG(J1,0)GOSUB1900,1800,1660,1670:NEXT:GOTO60
1650 REM**DIVIDE & MULTIPLY*****
1660 NL=N1:NC=N2*2+1:N3=N1*N2:GOTO1680
1670 N3=N1/N2:NL=N3:NC=N2*2+1
1680 IFNL>10THENRETURN
1690 FORJ=1TONL:PRINT"";:FORK=1TON2:PRINT"  ";:NEXT
1700 IFJ=NLTHENPRINT"";:GOTO1720
1710 PRINT""
1720 NEXT
1730 FORJ=1TONL:PRINT"";:IFJ>1GOTO1750
1740 PRINT"┌";:FORK=1TONC:PRINT"-";:NEXT:PRINT"┐":GOTO1770
1750 PRINT"├";:
1760 FORK=1TONC:PRINT"-";:NEXTK:PRINT"┤"
1770 PRINTJ;TAB(4)"|";TAB(NC+5)"|":NEXTJ
1780 PRINT"└";:FORK=1TONC:PRINT"-";:NEXTK:PRINT"┘":GOSUB530:RETURN
1790 REM****SUBTRACT REV***
1800 N3=N1-N2:PRINT"";
1810 K=0:FORJ=1TON1:PRINT" ";:K=K+1:IFK>9THENPRINT:PRINT"";:K=0
1820 NEXT:PRINT:GOSUB530:PRINT"";
1830 K=0:FORJ=1TON2:PRINT"";
1840 K=K+1:IFK>9THENPRINT:PRINT"";:K=0
1850 FORK1=1TO100:NEXT:NEXT
1860 K=0:PRINT"";:FORJ=1TON1:PRINT"";:K=K+1
1870 IFK>9THENPRINT:PRINT"";:K=0
1880 NEXT:PRINT:GOSUB530:RETURN
1890 REM****ADD REV**
1900 N3=N1+N2:PRINT"";
```


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PROGRAMS

```
 1910 K=0:FORJ=1TON1:PRINT"■ ";:K=K+1:IFK>9THENPRINT:PRINT"■■■■■■■";:K=0
 1920 NEXT:FORK1=1TOPP:NEXT
 1930 FORJ=1TON2:IFK>9THENPRINT:PRINT"■■■■■■■";:K=0
 1940 PRINT"■■";:K=K+1:FORK1=1TO100:NEXT NEXT
 1950 PRINT:GOSUB530:RETURN
READY.
```

BBC Engine Failure

by Ian Watt

This adventure game will run on either a model A or B BBC Computer.

As adventures go, it's not stunningly unusual — but it is fun to play. As with all decent adventures you need a modicum of patience to play it, but that never did anyone any harm. It has to be said that you can cheat by following the listing closely, but the penalty there lies with your own conscience. . .

By way of an outline, you're in a spaceship whose engines have failed (a dire situation) while you're orbiting a planet. The fact that you're in orbit means you're in danger of burning to a crisp in the planet's atmosphere in just a few minutes. You are the hero whose job is to repair the ship and therefore save the lives of all the grateful crew.

You must move throughout the ship and onto the planet, picking up objects (which may or may not be useful) as you go. The computer is not above offering its help if you ask it nicely.

Engine Failure is quite straightforward to run and contains all the instructions you'll need.

```
>LIST
   10 REM ENGINE FAILURE BY IAN R. WATT
   20 REM AN ADVENTURE FOR BBC MICRO
   30 DIM E(19)
   40 MODE 7:X=0:W=0
   50 CLS:PRINT''CHR$129"Do you want the instructions(Y or N) ?";:Z$=GET$:IF Z$
="N" THEN 200 ELSE IF Z$="Y" THEN 60 ELSE 50
   60 CLS:VDU 31,0,12,130:PRINT" If the caps lock is not on then put it"CHR$130"
on."
   70 FOR Z=1 TO 5000:NEXT Z
   80 CLS:PRINT'CHR$131" You are orbiting round a planet when  "CHR$131"the engi
nes fail."
   90 FOR Z=1 TO 5000:NEXT Z
  100 PRINT'CHR$132"You have a limited time before the ship"CHR$132"burns up in
the atmosphere in which to "CHR$132"repair the engines."
  110 FOR Z=1 TO 7500:NEXT Z
  120 PRINT'CHR$133" You have to direct the computer to    "CHR$133"manipulate t
he objects you may come   "CHR$133"across."
  130 FOR Z=1 TO 7500:NEXT Z
  140 PRINT'CHR$134" The computer has a fairly large number"CHR$134"of commands;
therefore if one command   "CHR$134"does not work then try another."
  150 FOR Z=1 TO 10000:NEXT Z
  160 PRINT'CHR$130" The program is designed so that only  "CHR$130"the first th
ree letters of each command"CHR$130"and object need be typed in,although,if"CHR$
130"desired,the full word may be entered."
  170 PRINT'CHR$131" N.B.:To move,simply type the initial"
  180 PRINT'CHR$134" eg. N for North."
  190 FOR Z=1 TO 15000:NEXT Z
  200 RESTORE 1370:FOR Z=1 TO 19:READ z:E(Z)=z:NEXT Z
  210 CLS:A=1:L=0
  220 RESTORE
  230 W=W+1:IF W>20 AND W<40 THEN PRINT"It is becoming warm."
  240 IF W>39 AND W<60 THEN PRINT"It is hot."
  250 IF W>59 AND W<80 THEN PRINT"It is very hot."
  260 IF W>79 THEN PRINT"The ship is burning up."
  270 IF W=100 THEN PRINT"The ship has blown up.":GOTO 850
  280 IF A=5 AND E(10)<>0 THEN PRINT"You have been shot by guards.":GOTO 850
  290 IF (E(16)<>16 OR E(17)<>16) AND A=5 THEN PRINT"You have caught a lethal di
sease.":GOTO 850
  300 FOR B=1 TO A:READ A$:NEXT
  310 VDU 31,0,3,130:PRINTA$
  320 PRINT'CHR$131"Evident exits:- ";:RESTORE 580:FOR C=1 TO A:READ D:NEXT:IF D
<>0 THEN PRINT":North:";
  330 RESTORE 590:FOR C=1 TO A:READ D:NEXT:IF D<>0 THEN PRINT":South:";
  340 RESTORE 600:FOR C=1 TO A:READ D:NEXT:IF D<>0 THEN PRINT":East:";
  350 RESTORE 610:FOR C=1 TO A:READ D:NEXT:IF D<>0 THEN PRINT":West:";
  360 PRINT''CHR$132"Objects:- ";
  370 H=0:RESTORE 730
  380 FOR G=1 TO 19:READ C$:IF E(G)<>A OR H=4 THEN NEXT ELSE PRINT":";C$;":";:H=
H+1:IF H<>2 THEN NEXT ELSE PRINT'"          "CHR$132;:NEXT
```


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PROGRAMS

```
  390 PRINT''CHR$133"Inventory:- ";
  400 F=0:RESTORE 730
  410 FOR G=1 TO 19:READ C$:IF E(G)<>0 AND E(G)<>-1 OR F=4 THEN NEXT ELSE PRINT"
:";C$;":";:F=F+1:IF F<>2 THEN NEXT ELSE PRINT'"                    "CHR$133;:NEXT
  420 VDU 31,0,13,129:PRINT"[----------------------------------------]"
  430 VDU 31,0,17,129:PRINT"[----------------------------------------]":VDU 31,0,15
,134
  440 INPUT"Command? "B$
  450 CLS:VDU 31,1,19
  460 IF LEFT$(B$,3)="WEA" OR LEFT$(B$,3)="ENT" OR LEFT$(B$,3)="EXI" OR LEFT$(B$
,3)="EAT" THEN 620
  470 IF LEFT$(B$,1)<>"N" THEN 480 ELSE RESTORE 580:FOR C=1 TO A:READ D:NEXT:IF
D=0 THEN 530 ELSE 520
  480 IF LEFT$(B$,1)<>"S" THEN 490 ELSE RESTORE 590:FOR C=1 TO A:READ D:NEXT:IF
D=0 THEN 530 ELSE 520
  490 IF LEFT$(B$,1)<>"E" THEN 500 ELSE RESTORE 600:FOR C=1 TO A:READ D:NEXT:IF
D=0 THEN 530 ELSE 520
  500 IF LEFT$(B$,1)<>"W" THEN 510 ELSE RESTORE 610:FOR C=1 TO A:READ D:NEXT:IF
D=0 THEN 530 ELSE 520
  510 GOTO 620
  520 A=A+D:IF A=12 THEN 1080 ELSE 220
  530 PRINT"No exit!"
  540 GOTO 220
  550 DATA Control room,Living quarters,Medical quarters,Teleport terminal,Mine
on planet
  560 DATA Computer storage banks,Cargo hold,Shuttle bay,Inside of shuttlecraft,
Engine servicing room
  570 DATA Weaponry,Right engine,Left engine,Supply depot,Workshop
  580 DATA 0,-1,0,0,0, 3,0,0,0,-3,0,0,-2,0,0
  590 DATA 1,0,3,0,0,0,3,0,0,0,2,0,0,0,0
  600 DATA 0,1,0,-2,0,1,0,-2,0,0,-3,-2,0,-3,-2
  610 DATA 0,2,-1,0,0,2,-1,3,0,2,3,0,2,0,0
  620 M=0:N=0:O=0:IF LEFT$(B$,3)="TEL" THEN 860 ELSE IF LEFT$(B$,3)="QUI" THEN 8
50 ELSE IF LEFT$(B$,3)="HEL" THEN 1040
  630 RESTORE 760:FOR I=1 TO 11:READ C$:IF LEFT$(B$,3)=C$ THEN M=I
  640 NEXT I:IF M<>0 THEN 660
  650 PRINT"I do not understand you.":GOTO 220
  660 RESTORE 730:D$=RIGHT$(B$,3):FOR J=1 TO 19:READ C$:C$=LEFT$(C$,3)
  670 FOR K=4 TO 15:IF LEFT$(D$,1)<>" " AND C$=MID$(D$,2,4) THEN N=1
  680 IF C$=MID$(D$,2,3) THEN O=J ELSE D$=RIGHT$(B$,K)
  690 NEXT K:NEXT J:IF O<>0 THEN 700 ELSE PRINT "Pardon?":GOTO 220
  700 IF N=1 THEN PRINT"Learn to type."
  710 ON M GOTO 780,890,940,970,1090,1130,1170,1200,1240,1270,1300
  720 GOTO 220
  730 DATA BLUE BUTTON,RED BUTTON,YELLOW BUTTON,LIGHT-BLUE,LIGHT-RED,LIGHT-YELLO
W
  740 DATA ASTRAGEM,SHUTTLECRAFT,FLOPPY DISK,ZAPPERGUN,SPACESUIT,SCREWDRIVER,PAN
EL,LEVER
  750 DATA JEWEL-SOCKET,WATER,TABLET,PLIERS,PCB
  760 DATA PRE,GET,DRO,INS,WEA,ENT,EXI,UNS,PUL,DRI,EAT
  770 PRINT"I cannot do that.":GOTO 220
  780 IF O>3 THEN 770
  790 IF O=2 AND E(15)=16 THEN 1330
  800 IF O=2 AND E(5)<>1 OR O=1 AND E(4)=1 OR O=3 AND E(6)=1 THEN PRINT"The ship
 has blown itself up.":GOTO 850
  810 IF O=3 AND E(4)=1 THEN PRINT"A yellow light comes on.":E(4)=16:E(6)=1:GOTO
 220
  820 IF O=1 AND E(6)=1 THEN PRINT" A pcb has just materialised in part of the s
hip.":E(6)=16:E(19)=10:GOTO 220
  830 IF O=1 OR O=3 THEN PRINT"Nothing happens.":GOTO 220
  840 PRINT"The teleport has been activated.":L=1:E(5)=16:GOTO 220
  850 VDU 23;11,0;0;0;0;31,5,23:PRINT"Press space to start again.":IF INKEY$(50)
=" " VDU 23;11,255;0;0;0;:GOTO 40 ELSE VDU 31,5,23:PRINT"
      ":IF INKEY$(50)=" " VDU 23;11,255;0;0;0;:GOTO 40 ELSE 850
  860 IF L=0 OR A<>4 AND A<>5 THEN 770
  870 IF A=4 THEN A=5 ELSE IF A=5 THEN A=4
  880 PRINT"O.K.":GOTO 220
  890 IF O<7 OR O=8 OR O=13 OR O=14 OR O=19 THEN 770
  900 IF F=4 THEN PRINT"I am carrying too much.":GOTO 220
  910 IF E(O)<>A THEN 930
  920 E(O)=0:GOTO 880
  930 PRINT"I do not see it here.":GOTO 220
  940 IF E(O)<>0 AND E(O)<>-1 THEN PRINT"I am not carrying it.":GOTO 220
  950 IF H=4 OR A=1 THEN PRINT"I do not see a place to put it.":GOTO 220
  960 E(O)=A:GOTO 880
  970 IF O<>9 AND O<>7 AND O<>15 THEN 770
  980 IF E(O)<>0 AND E(O)<>-1 THEN PRINT"I do not have it to insert.":GOTO 220
  990 IF A<>1 AND O=9 OR O=7 AND E(15)<>0 OR O=15 AND A<>10 THEN PRINT"I do not
see a place to insert it.":GOTO 220
 1000 IF O=7 THEN E(O)=16:E(15)=-1:GOTO 880
 1010 IF O=9 THEN 1030
 1020 IF O=15 AND E(18)=0 THEN E(O)=16 ELSE 770
 1030 PRINT"A red light comes on.":E(5)=1:E(4)=16:E(9)=16:GOTO 220
 1040 IF A=1 AND E(9)=0 THEN PRINT"Try inserting the floppy disk.":GOTO 220
 1050 IF A=13 THEN PRINT"Try unscrewing the panel.":GOTO 220
 1060 IF A=2 OR A=3 THEN PRINT" A tablet taken with water prevents the catching
of a lethal disease.":GOTO 220
 1070 PRINT"There is no help available to give.":GOTO 220
 1080 PRINT"Your pet ORIGONK has mistaken you for  an intruder and has killed yo
u.":GOTO 850
 1090 IF O<>11 THEN 770
 1100 IF E(O)<>0 AND E(O)<>-1 THEN PRINT"I am not carrying it.":GOTO 220
 1110 IF E(O)=-1 THEN PRINT"I am already wearing it.":GOTO 220
 1120 E(O)=-1:GOTO 880
 1130 IF O<>8 THEN 770
 1140 IF A<>8 THEN 930
```


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PROGRAMS

```
1150 IF E(11)<>-1 THEN PRINT"You have been destroyed by nerve gas.":GOTO 850
1160 A=9:GOTO 220
1170 IF O<>8 THEN 770
1180 IF A<>9 THEN PRINT"I am not inside it.":GOTO 220
1190 A=8:GOTO 220
1200 IF O<>13 THEN 770
1210 IF A<>13 THEN 930
1220 IF E(12)<>0 THEN PRINT"I need a screwdriver.":GOTO 220
1230 E(14)=13:E(13)=16:GOTO 880
1240 IF O<>14 THEN 770
1250 IF E(14)<>A THEN 930
1260 PRINT"A blue light comes on.":E(4)=1:E(5)=16:GOTO 220
1270 IF O<>16 THEN 760
1280 IF E(0)<>0 THEN PRINT"I do not have any water.":GOTO 220
1290 E(0)=16:GOTO 880
1300 IF O<>17 THEN 760
1310 IF E(0)<>0 THEN PRINT"I do not have a tablet.":GOTO 220
1320 GOTO 1290
1330 PRINT"Congratulations----The ship is now fully operational."
1340 Q=100-W:IF Q>X THEN X=Q
1350 PRINT"Score=";Q;"   Best score=";X
1360 GOTO 850
1370 DATA 1,1,1,16,16,16,5,8,6,11,14,9,13,16,15,2,3,7,16
>VDU 3
```

ZX81 Molecular Weight

by Mike Whitcombe

Those of you whose occupations are scientific will find this program useful.

It works out molecular weight and atomic percentage for various compounds. It runs on a 16k ZX81 but could be modified to run on a ZX80 with an 8k ROM.

The program is entered from the keyboard and then saved by entering GOTO 630. Loading it back from tape will then run it automatically. Initially only four elements are 'known' by the program, but more can be included up to a maximum of 20. This is done by increasing the sizes of arrays A$ and A. Elements 'learned' are retained by the program as long as CLEAR or RUN are not used. An updated version of the program is saved by entering GOTO 630. After exiting the program it can be run again by typing GOTO 120.

```
 5  DIM C$(1,2)
10  DIM A$(20,2)
20  DIM A(20)
30  LET A$(1)="C"
40  LET A$(2)="H"
50  LET A$(3)="N"
60  LET A$(4)="O"
70  LET A(1)=12.011
80  LET A(2)=1.0079
90  LET A(3)=14.0067
100 LET A(4)=15.9994
110 LET A=5
120 CLS
```


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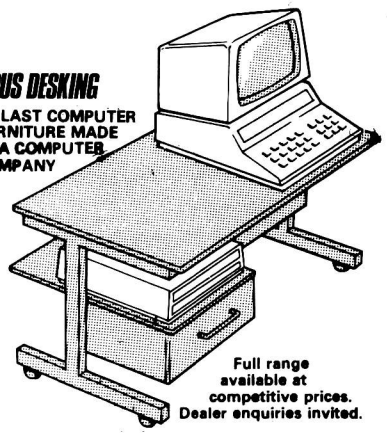

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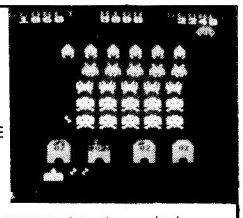

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PROGRAMS

```
125  PRINT "ENTER NUMBER OF ELEMENTS IN YOUR COMPOUND"
13Ø  INPUT B
14Ø  PRINT B
15Ø  DIM B(B,3)
155  SCROLL
16Ø  FOR C=1 TO B
17Ø  SCROLL
18Ø  PRINT "ENTER ELEMENT SYMBOL"
19Ø  SCROLL
2ØØ  INPUT C$(1)
2Ø5  IF C$(1)="" THEN GOTO 2ØØ
21Ø  PRINT C$(1)
22Ø  SCROLL
23Ø  PRINT "ENTER NUMBER OF ";C$(1);" ATOMS"
24Ø  SCROLL
25Ø  INPUT D
26Ø  PRINT D
27Ø  LET B(C,1)=D
28Ø  FOR E=1 TO A-1
29Ø  IF A$(E,1)<>C$(1,1) THEN GOTO 32Ø
295  IF LEN C$(1)=1 OR A$(E,2)<>C$(1,2) THEN GOTO 32Ø
3ØØ  LET B(C,2)=E
31Ø  GOTO 42Ø
32Ø  NEXT E
33Ø  SCROLL
34Ø  PRINT "I DONT KNOW THIS ELEMENT ";C$(1)
35Ø  SCROLL
```


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PROGRAMS

```
360  PRINT "PLEASE ENTER ITS AT. WT."
370  INPUT F
380  LET A(A)=F
390  LET A$(A)=C$(1)
400  LET A=A+1
410  GOTO 280
420 NEXT C
430  CLS
440  LET TOT=0
450  FOR C=1 TO B
460  LET B(C,3)=B(C,1)*A(B(C,2))
470  LET TOT=TOT+B(C,3)
480  NEXT C
490  SCROLL
495  IF TOT=0 THEN GOTO 580
500  PRINT "M.W.= ";TOT
510  SCROLL
520  PRINT "EL"; TAB 4;"NO","PC"
530  FOR C=1 TO B
540  SCROLL
550  PRINT A$(B(C,2)); TAB 4;B(C,1),100*B(C,3)/TOT
560  NEXT C
570  PAUSE 100
580  SCROLL
590  PRINT "ANOTHER COMPOUND ? Y/N"
600  IF INKEY$="Y" THEN GOTO 120
610  IF INKEY$="N" THEN STOP
```


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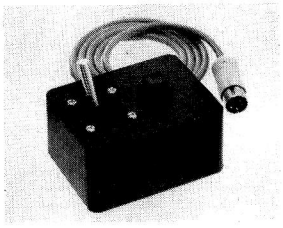

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PROGRAMS

```
62Ø  GOTO 6ØØ
63Ø  SAVE "MW"
64Ø  GOTO 12Ø
65Ø  REM MOLECULAR WEIGHT AND ATOMIC PERCENTAGE PROGRAM
66Ø  REM COPYRIGHT M.J. WHITCOMBE 1982
```

Adventure in 1k

by Ian Stansfield

This is the ultimate transportable program. With an absolute minimum of adaptation (or none at all) it will run on any micro you might care to name (apart from those which don't support Basic, but there's only one of those at present). In fact its transportability is quite sickening.

Furthermore it's a whole adventure in well under 1k of memory. It will provide hours of fun and entertainment for all the family as long as they are either schizoid or possessed of an IQ below 30. It's also very easy to understand and modify. Just key it in and run. . .

Oh, and for the connoisseur, there's also a version written in C, for the sake of a little linguistic variety.

```
10 REM*****1k ADVENTURE*****
20 PRINT"YOU ARE IN A CAVERN..."
30 PRINT"NORTH, SOUTH, EAST OR WEST?"
40 INPUT A$
50 GOTO 20
```

C VERSION

```
main()
{
char c;
START:
printf("You are in a cavern...\n");
printf("North, South, East or West");
c=getchar();
goto start;
}
```

Beebdump

by Francis Courtney

The program is a utility program for the BBC Micro connected to an Epson MX-80F/T III printer, and is designed to copy the screen on to the paper of the printer. It should be used in the same manner as a subroutine or PROCedure. The program occupies lines 10000 to 10430 in increments of 10, and as such should not be used with programs which have line numbers between these two figures as these lines will

be replaced by the lines in the dump program.

The program has the ability to produce two sizes of pictures, one small and one large. When one wishes to jump to the dump routine a small sound is heard and the space bar has to be pressed, see line 10010. One must now choose what size picture is required by pressing 1 for a small picture, 2 for a large picture. A small picture takes approximately five minutes to be reproduced, a large picture about 20 minutes.

The program works by reading a character horizontally and 255 pixels vertically, storing this in a DIMensioned variable and then printing it on the printer. When the pixel read is roughly greater then 950 the rest of the line is printed and the computer starts to read the next column of pixels.

The program is loaded by using the command *EXEC "SCREENDUMP"; this will allow a program already existing in memory not to be replaced unless line numbers of one program are the same as those of the dump program. To save the program use the command *SPOOL "SCREENDUMP" <CR> LIST <CR> *SPOOL <CR>.

```
10000 VDU7
10010 REPEAT UNTILGET=32
10020 SOUND1,-15,3,10
10030 REM ===============
10040 REM   SCREEN DUMP
10050 REM ---------------
10060 REM    BBC  (B) &
10070 REM EPSON MX-80F/T 3
10080 REM BY F. Courtney
10090 REM ===============
10100 DIM C%(8),DC%(480)
10110 SZ%=VAL(GET$)
10120 C2%=0
10130 IF SZ%=2 THENC2%=2:SI%=16:W%=75:P%=255
10140 IF SZ%=1 THENC2%=4:SI%=32:W%=37:P%=255/2
10150 IF C2%=0 THEN GOTO 10110
10160 *FX6
10170 M%=510
10180 VDU1,27,1,81,1,W%,1,27,1,51,1,22
10190 C%(1)=1:C%(2)=2:C%(3)=4:C%(4)=8:C%(5)=16:C%(6)=32:C%(7)=64:C%(8)=128
10200 VDU2:PRINT'':VDU3
10210 FOR X%=0 TO 1279 STEP SI%
10220   FOR Y%=0 TO 1019 STEP M%
10230     FOR Y1%=Y% TOY%+M% STEPC2%
10240       FOR X1%=X% TO X%+SI% STEPC2%
10250         IF POINT(X1%,Y1%)<>0 PROCSHADE
10260         NEXT
10270       NEXT
10280     PROCPRINTER
10290     NEXT
10300   NEXT
10310 VDU1,7,1,7
10315 VDU1,27,1,51,1,30,1,27,1,81,1,80
10320 END
10330 DEFPROCPRINTER
10340 VDU 2,1,27,1,69,1,27,1,75,1,P%,1,128
10350 FOR PC%=1 TO P%
10360   VDU 1,DC%(PC%)
```


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PROGRAMS

```
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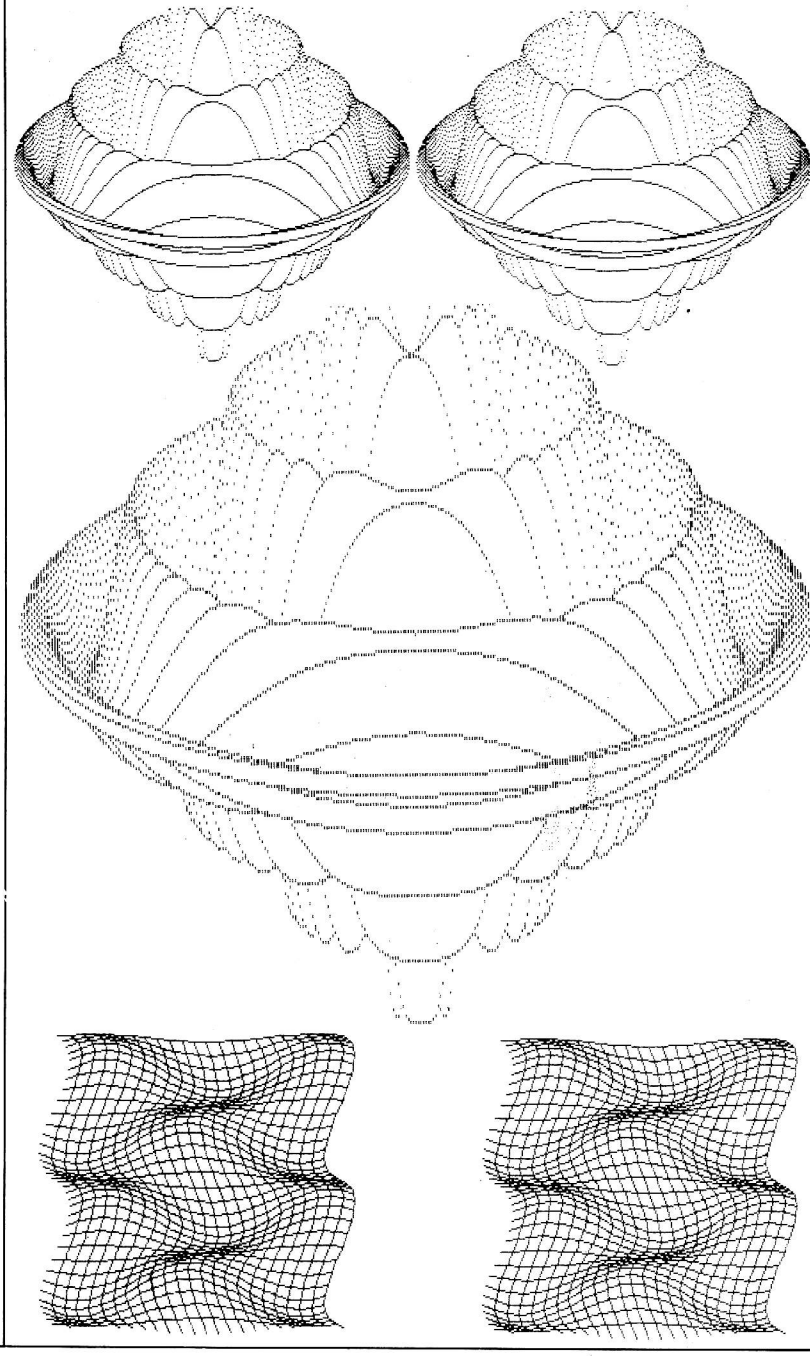
10380   NEXT
10390 VDU3
10400 ENDPROC
10410 DEFPROCSHADE
10420 DC%((Y1%-Y%)/C2%)=DC%((Y1%-Y%)/C2%)+C%((8-(X1%-X%)/C2%))
10430 ENDPROC
```



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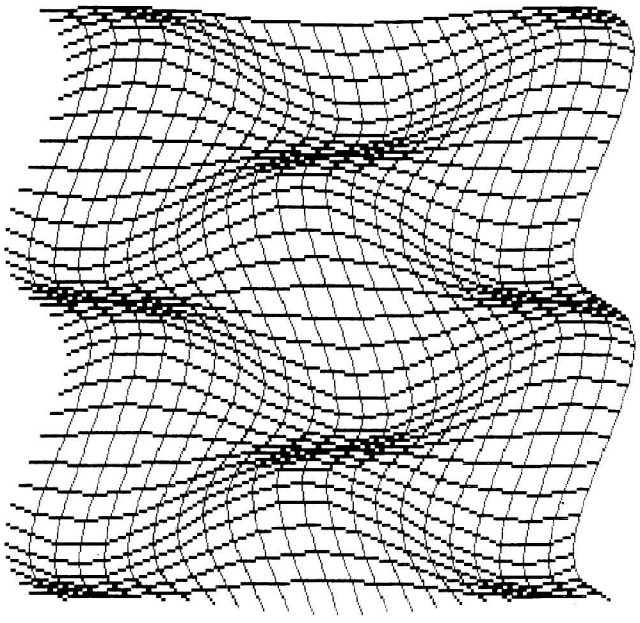

Examples of Beedump output!

TRS-80 Word Scrambler

by Derek Clarkson

Here's how to find out if your name (or those of your friends) contain any rude or naughty words. It was written for a TRS-80/Video Genie with at least 16k of memory.

It's easy to use — all that has to be done is for the user to enter the word to be scrambled and press 'newline' to prompt the computer to start its dirty work. The scrambled words then appear on the screen. Large words can result in a vast number of permutations and not all of these may fit into memory. In such cases, the machine will carry on outputting random words until its memory is full, when it gives an 'out of memory' error.

The program includes a check to make sure the same permutation is not printed more than once. This is contained in lines 330 to 350. If you have a printer, simply change line 370 to LPRINT instead of PRINT and all output goes to the printer instead of the screen.

```
10 CLS:CLEAR 11000:DIM P$(999):M=1:N=1
20 PRINT"THIS IS A SYSTEM FOR SHOWING
   PERMUTATIONS OF A WORD."
30 PRINT
40 INPUT"YOUR CHOSEN WORD IS..";W$
50 L = LEN(W$)
60 PRINT"YOUR WORD HAS ";L;"
   LETTERS"
70 IF L = 0 THEN 10
```


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PROGRAMS

```
80 LA = L: LB = L
90 LA = LA - 1
100 IF LA = 0 THEN 130
110 LB = LB * LA
120 GOTO 90
130 PRINT"AND HAS "; LB ;
    "WAYS OF BEING WRITTEN."
140 DIM W(L),R(L)
150 REM RANDOM ROUTINE
160 FOR J = 1 TO L
170 W(J) = ASC(MID$
    (W$,J,1))
180 NEXT J
190 N=1
200 R=RND(L)
210 FOR J=1 TO N
220 IF R=R(J) THEN 200
230 NEXT J
240 R(N)=R:N=N+1
250 IF L+1>N THEN 200
260 FOR J = 1 TO L
270 X$ = X$+CHR$(W(R(J)))
280 NEXT J
290 FOR J = 1 TO  L
300 R(J)=0
310 NEXT J
320 REM MEMORY STORE
     & CHECK
330 FOR J = 1 TO M
340 IF P$(J)=X$
    THEN  390
350 NEXT J
360 P$(M)=X$
370 PRINTM" = ";X$
380 M = M + 1
390 X$=""
400 IF M =  LB  + 1
    THEN END ELSE 190
```

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Programs has been attacked by the famous SHMRDLU — error-proneness disease — in recent months. Still, your intrepid programs editor has searched the four corners of the globe and come up with some answers on those programs which have been causing the trouble.

VIC UFO, January PCW:

This one was rather difficult to read, as it was typed out rather than printed on a proper printer. However, one or two typing

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errors were discovered in the listing. I'll list these in order of line number. Line 34 should end in THEN 64 (not 66); line 35 should end in THEN 85 (not 75); line 38 should end in THEN 55 (not 54); and line 39 should end in THEN 85 (not 75). This program also contained some ambiguities — for those of you who are absolute beginners the instructions in brackets (eg, (cursor up, clear screen)), should not be typed in literally — they stand for symbols explained in the VIC manual which are used in programs to perform the operations described in the brackets. A '1' with an asterisk typed seemingly over it is '1' and not '*'. And in line 26 an address is POKEd with what looks like a value of 80. It should be variable SO.

VIC Doppler, January PCW:

Doppler was another program which was typed out from a screen display, and also suffered a number of typing errors. (There's nothing wrong with a typed listing as long as it's meticulously checked). These mistakes are simple to rectify and are as follows: Line 3 contained an extra comma and should read FOR I=1 TO NS:READR(I), TH,PH:TH(I)=TH* π /180:PH (I)=PH* π /180:NEXT line 806 has a decimal point missing. At the end of the line a variable named HG is given the value 2018. It should be 201.8. Line 2142 has an exponential sign within it which is given no argument. That should be 2. Line 3090 has a comma included in place of a decimal point and (as it hasn't reproduced very well) should read: DATA 750,106.5, 355.4,2700,119,339.8. The other problem with this listing is not to confuse 1 with I and 0 with O. This applies also to UFO.

Hopefully these corrections should clear up any readers' problems with these programs.

THE ORIC·1

Continued from page 165

This being so, it is impossible to recommend the Oric-1 unreservedly. However, when final ROMs have been installed and consequently the present bugs have been dealt with, and if Oric rewrites its manual to a higher standard, then the Oric-1 should prove to be a best-selling machine. It's just unfortunate that Oric should have set about marketing its product in this unprofessional and slapdash way — it can do the company's reputation no good and, what is worse, it's liable to be reflected in the consumer developing a distrust of the computer that, subject to those improvements mentioned above, it really does not deserve.

Erratum

Earlier in this review I made some disparaging comments about the fact that the Oric has no PRINT AT facility. This is, in fact, not the case — the Oric's equivalent to PRINT AT takes the form PLOT x,y where x and y are column and row coordinates. This is applicable in both TEXT and LORES modes — in HIRES, CHAR must be used. My apologies to Oric for this unwarranted slur.

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BM3	29.35
BM4	31.72
BM5	38.10
BM6	50.10
BM7	76.08
BM8	233.40

All timings in seconds. Please note that BM8 now gives the timing for 1000 iterations of the loop — previous Benchmarks have referred to 100 passes. For a full explanation of Benchmark timings, see PCW *November 1982.*

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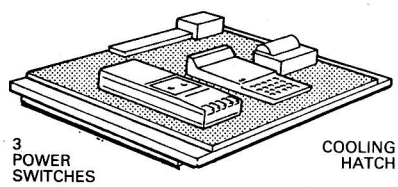

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MICRO CHESS

Continued from page 197

(Although it is tempting to put a rook on the 7th rank, I would have preferred 19 a4xb5, since now the passed Black a-pawn becomes a real menace.)

19	. . .	b5xa4
20	Rc7xb7	Qe7-d6
21	Rfl-cl	Rf6-f8
22	Rcl-c7	Rf8-c8
23	Qd3-c4	Rc8xc7
24	Rb7xc7	a4-a3

(Suddenly White is lost — the a-pawn cannot be stopped.)

25	Qc4-c5	Qd6xc5
26	Rc7xc5	a3-a2
27	h2-h3	a2-al=Q+
28	Kgl-h2	Qal-b2
29	Rc5-c7	Qb2-b5
30	Nf3-g5	Ra8-a6
31	Ne5xd7	Nb8xd7
32	Rc7-c8+	Nd7-f8
33	Ng5xh7	Kg8xh7
34	Rc8xf8	Qb5-c6
35	g2-g3	Qc6-f3
36	Rf8xf5	

(Bogol now realised that 36 Kh2-g1 allows mate in two starting with 36 . . . Ra6-al+, and so sacrifices a rook in desperation.)

36	. . :	e6xf5
37	h3-h4	Ra6-al+
38	Kh2-h3	Ral-hl mate

While the above game is not spectacular, it does show how La Regence is able to create modest strategical opportunities from seemingly placid situations (17 . . . a7-a6!) and to capitalise on its positional advantages with great force.

THE MULTI-USER SIGNET

Continued from page 122

McNOS command language that he asked to have it implemented on his single-user CP/M systems as well.)

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Future developments

A user who is just starting on a microcomputer development which requires only one system now but which could expand to become multi-user later, could well choose a Sig/net system for its development potential. If Shelton maintains its record in exploiting its technical expertise, then it would be expected that other developments would be on the way. I understand that one of these developments is the provision of a local area network facility based upon the Datapoint ARCNET approach. This will be used instead of the current ribbon bus to provide high speed communication over much longer distances, and thus permit the siting of user satellite systems away from the central hub. I must point out however that this is not yet an available product, or, as Guy Kewney so aptly put it in this same magazine 'the future is not now . . .'.

Conclusions

The Shelton Sig/net system is based on good hardware and provides good value for money. The system provides a convenient cost-effective growth-path for the user who wants to start small, but expects to expand to a multi-user system later. The McNOS multi-user operating system provides convenient facilities for users who wish to share data between a number of terminals and a number of CP/M programs, provided this can be done on a scheduled basis (ie, no file being used in

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update mode by more than one user at a time). It is also possible to share simultaneous update access to the same data files with programs written specifically to take advantage of the McNOS 'locking' mechanism. The powerful McNOS terminal command language would be useful in some circumstances, but can be slow to use.

Our thanks to Senton Ltd of Bristol for generous access to both single-user and multi-user Sig/net systems, and for stimulating discussions on the subject of resource 'locking' in general, and using McNOS in particular. Shelton Instruments Ltd readily provided all the additional information I sought.

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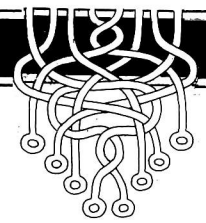

by J J Clessa

Quickie

No answers no prizes.

A saucer is floating in a bath tub. Which raises the water level more — dropping a penny into the saucer or into the bathtub?

Prize Puzzle

If a 2-digit number is reversed and added to itself, and the process repeated, eventually a palindromic number will result (ie, one which reads the same forward as backward).

Thus, consider the number 19.

When reversed, gives 91.

19 + 91 = 110

110 + 011 = 121, which is palindromic after only two operations.

Which 2-digit number requires the most number of operations before a palindromic sum is reached — and how many are required? (Clearly there are two answers — since one will be the reverse of the other. We'll accept either.)

January Prize Puzzle

A fairly easy puzzle in January — well over 200 responses were received.

The problem can easily be solved by both analytical and micro methods. Many readers sent in the necessary programs. The answer is that there were 288 runners in the race and his number was 204. (Hardly the London Marathon!)

The winning entry chosen from the pile came from Mr N R Holland of South Chingford, London. Congratulations are in order, and of course a small matter of a prize, which will be on its way pronto.

BLUDNERS

We've had a lot of irate phone calls about our Lynx Benchmarks as printed in March *PCW*. Some people seem to think Benchmark 8 is wrong. Well it's not. It'd help everyone if they noted that Benchmark 8 timings as printed in November 1982's summary should be multiplied by 10 to keep in line with the new BM8 program which tests three transcendental functions 1000 times instead of the previous count of 100. The average timings are all calculated using the BM8 times multiplied by 10. What did go wrong was that the average was incorrect — it should be 21.3 seconds. Now, we know BM8 looks a bit inconsistent with all the others, but we also know it's right, so please stop phoning us up to tell us it's wrong.

The User Group Index, as printed in the February issue, lacked one very important acknowledgement. It was provided by the Amateur Computer Club, which maintains a reliable database of clubs countrywide and kindly agreed to provide us with a copy of that database for our readers' use. In future the User Group Index will be known as the ACC User Group Database, and we'd like to apologise to the ACC for our inconsiderate omission.

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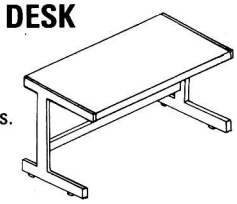

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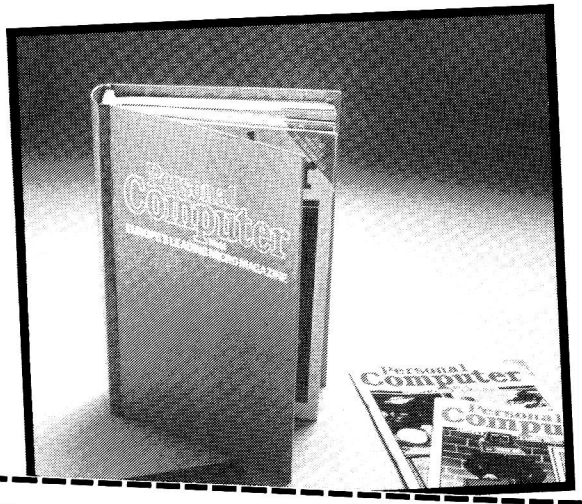

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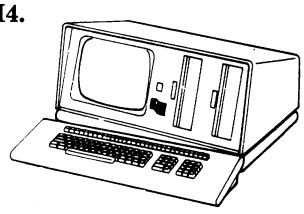

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Volume 1 No 2 1978
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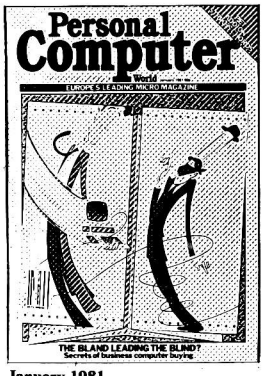
Volume 1 No 3, 1978
More efficient programs/Cosmac 1802/The PDP11 Part 1/Small busines computing — an approach/ The Z80/EPROM programmer construction.

Volume 3 No 6
June 1980
Benchtest: Tandy TRS-80 Model II/ Benchtest: Sintrom Periflex 630/48/ Staff case study/Checkout: Softy Intelligent EPROM Programmer/ Checkout: Exatron Stringy Floppy/ Practical examples of the IEEEE-48 bus use/Programs: Naming Nascom files/380Z Pictures/Fuel tank calculations — PET/PET large numerals/PET tank battle/Basic string handling.

Volume 3 No 12
December 1980
Benchtest: Microwriter/ Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs:TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon Benchtest: Raannd SP1

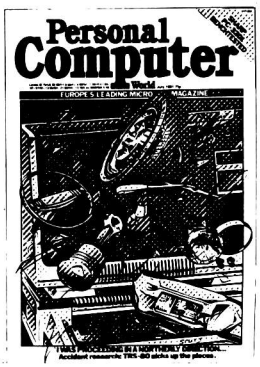


January 1981
Benchtest: Transam Tuscan/Real-time control using trains — part 1/ Recover from a data tape disaster/PET Music Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

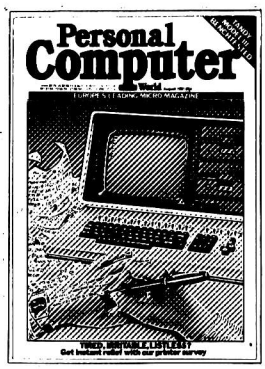
Volume 4 No 3
March 1981
Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.

Volume 4 No 5
May 1981
Benchtest: Pascal 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/ Using calculator printers on micros/ Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.

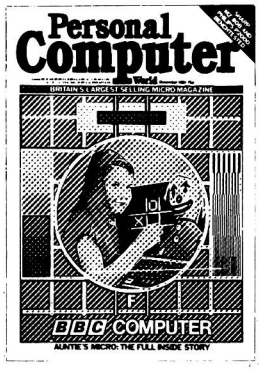
Volume 4 No 6
June 1981
Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 plus/Budget tape interface/Further Casio quirks/ Programs: UK101 Zor, PET Chords.



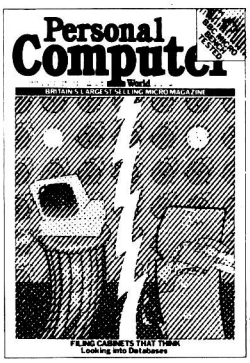
Volume 4 No 7
July 1981
Benchtest: Sharp PC-3201/Multi-user Benchtest: Acorn Econet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchtest: Format-80/Pascal Benchmarks: readers letters/Quicker Casio computations/Programs: ZX80 Sliding letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX91 Sketch Pad.



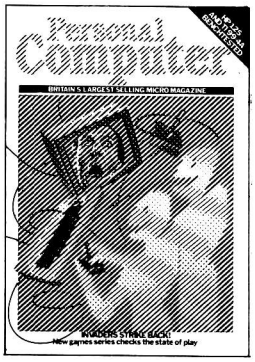
Volume 4 No 8
August 1981
Benchtest: Tandy Model III/ Viewdata update/WP Benchtest: Spellbinder/Printer survey/ Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.



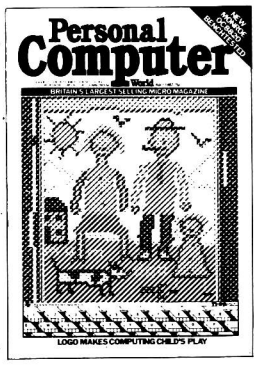
Vol 4 No 12
December 1981
Benchtests: Sharp MZ-80B Philips P2000/School network/BBC Micro inside story/'Turtle' Graphics for Apple/Forth language/Curve fitting/ Calc corner: HP14C review/ programs: PET Fantasy, ZX81 Battleships and cruisers.



Vol 5 No 1
January 1982
Benchtests: BBC Micro Xerox 820/Frames of Reference (new series)/ZX81 printer Checkout/ Digital Drummer for PET/Calc Corner: benchmarks/Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.



Vol 5 No 3
March 1982
Benchtests: Texas Instruments 99/ 4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS REVIEWED/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.



Volume 5 No 4
April 1982
benchtest; Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/Generating screen forms/Comal/ Logo/Brain Dump-New series/Calc Corner: Casio FP-10 printer/ Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.

Vol 5 no 6
June 1982
Benchtests: Sharp MZ-80A/ZX Spectrum/Database Benchtest: DBMS2/West Coast Fire Report/ Lisp/VIC 20 games/Calc Corner: Sharp PC1500/Programs: RML Altered Basic/VIC-20 Large Characters/BBC Breakout/VIC20 Trailblazer/MZ-80K Next-to-Last-One/MZ-80K Tarot.

Vol 5 No 7
July 1982
Benchtests: Mimi 801/Newbrain/ Database Benchtest: Silicon Office/ UCSD p-System/BBC Computer-in-Depth/Apple II games/ Calc Corner: T188/Programs: ZX81 Hypocycloids/BBC Character Generator/TRS-80 Truth/PET Doc/ TRS-80 Screen Dump/UK101 Screen Converter/PET boxes/Atari Earth.

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Vol 5 No 8
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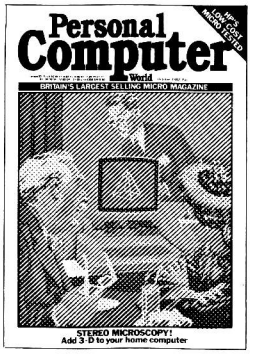
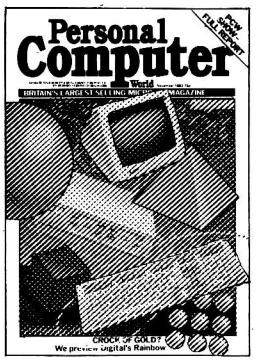
Benchtests: Sort M23/Dragon 32/ Database Benchtest: Cardbox/ Preview: Sony SMC-70/UCSD p-System/RS232 Interface/Sirius graphics/NCC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/ Apple Trees/Nascom Snail Racing/ UK101 Long Multiplication & addition.

Vol 5 No 9
September 1982
Benchtest: Olivetti M20/Word Processor Benchtest: Select for NEC/ Database Benchtest: Aquila/Checkouts: Microwriter Revisited, E40 Data Compression/ Screenplay: ZX81 Pt II/DIY Logo/ P for Perfect/Beeb Colour Hi Res/RS232/Calc Corner: HP15 and 16C reviewed/programs: Video Genie Extended Basic, ZX81 Alphabetising, PET File Comparison, BBC Music Player, PET Virus, BBC Radar, PET German Game, TRS-80 Cardshuffler.



Vol 5 No 10
October 1982
Benchtests: HP-86; Positron 9000/ Database Benchtest; Personal Pearl/ 3D Graphics for BBC Computer/Hashing Techniques/ Designing your own Database/CP/ M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc Corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.



Vol 5 No 11
November 1982
Benchtests: Canon CX-1; Hewlett Packard HP75/Database Benchtest: Condor/Apple II Clock Calendar Card Part — Algebra checking/ Benchmarks summary/Bit Stik graphics for Apple/Calc Corner — HP41C, Casio fx702p programs/ *PCW* Show report/Tiny printing on Centronics 739/Screenplay — Acorn Atom/Programs: Apple Piano; Apple Moon Module; PET Letterwriter; UK101 Logic; Atari Walls; Sharp MZ80K Area-filling; RML 380Z Restore.

Volume 6 No 2
February 1983
Benchtest: Sage/Database Benchtest: BusiPost/Which Spreadsheet — new series/Networks — new series/Expert systems/BBC graphics revealed/Logo Turtle/ Micro Chess — Fidelity's Prestige/ Portable Computer World — Sharp PC1251 Benchtested/Numbers Count/Screenplay — BBC games/ Programs — UK101 Vocabulary Test/PET Race Chase II/Apple Character Plotter/Variable Checkchart/ZX81 hex calculator/ Atom Backgammon/Video Genie Aircraft Lander/Atari Flashback/ MZ Text Analysis.

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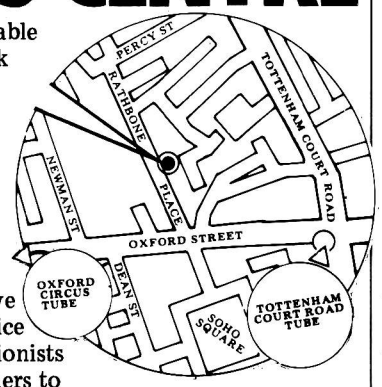

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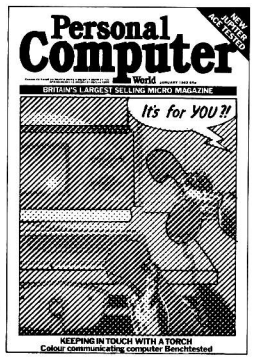

Volume 6 No 1
January 1983
Benchtests: Jupiter Ace/Torch/ Database Benchtest: Superfile/ Warnier-Orr programming tecniques/Expert systems/Tokyo Data Show report/Forth Benchmarks/Digital Video/The Nearly Man — Charles Babbage/ Portable Computer World — Continued Fractions/Micro Chess/Screenplay — Spectrum/ Programs: VIC Connect-4/ VICMon/Atari character set mover/VIC UFO/PET Forth Teacher/VIC Doppler/BBC Gomoku.

Volume 6 No 3
March 1983
Benchtests: Corvus Concept, Computers Lynx/Database Benchtest: DataPrism/Which Spreadsheet? —Prophet II/IBM 9000 Instrumentation Computer/ Apple Word Handler/Networks — Part II/ZX81 Graphics Module/Sharp MZ-80k Enhancements/Micro Chess — the Conchess range/Screenplay — Atari 800/Portable Computer World — hex listings for Casio fx602p and Sharp PC1211/Programs: Atari Animation/Chinese Horoscopes/ PET Patience.

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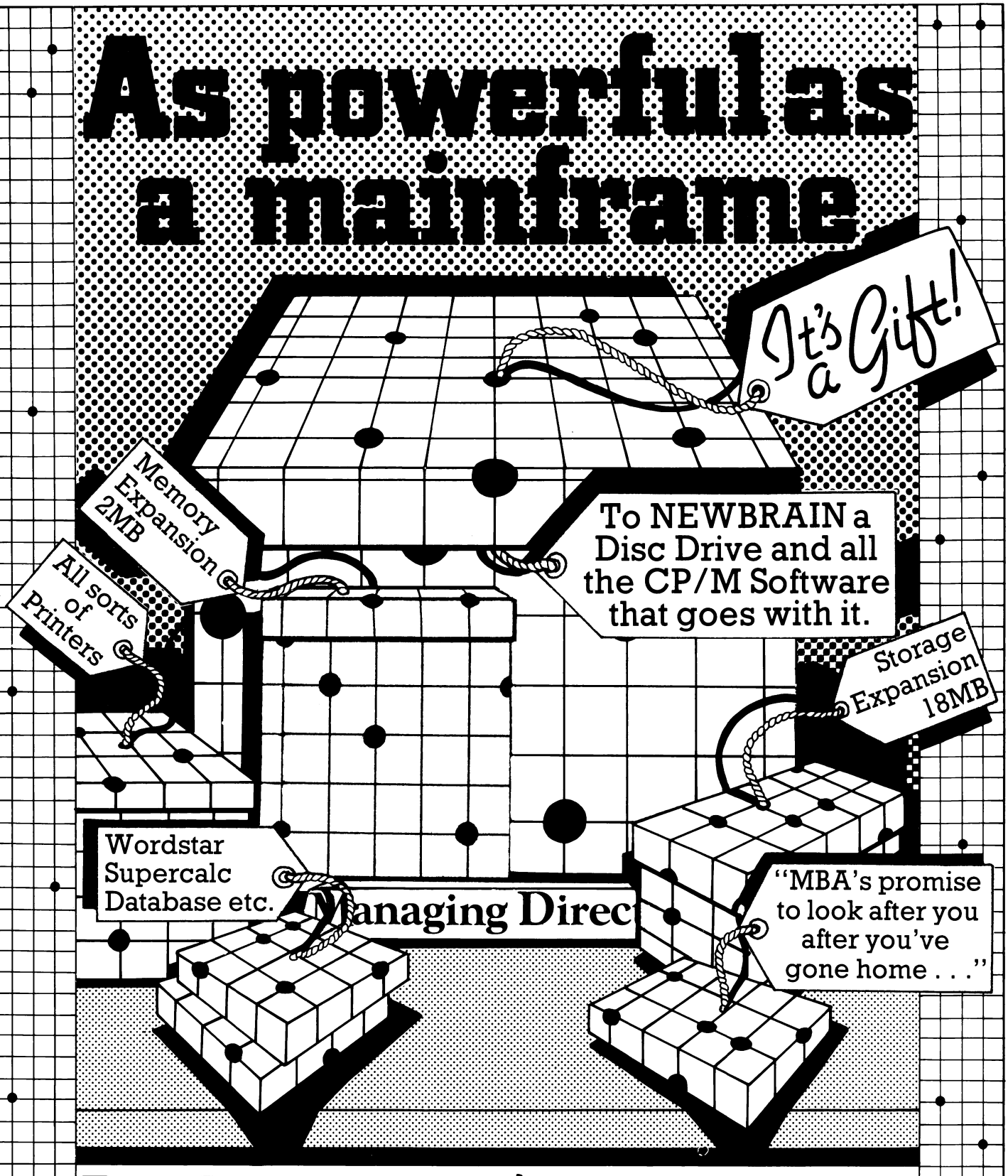

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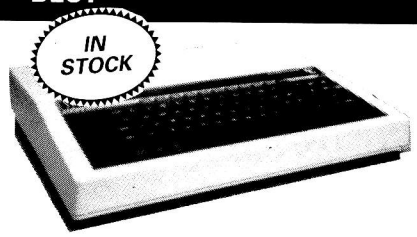

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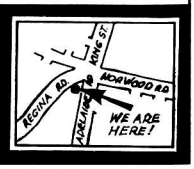

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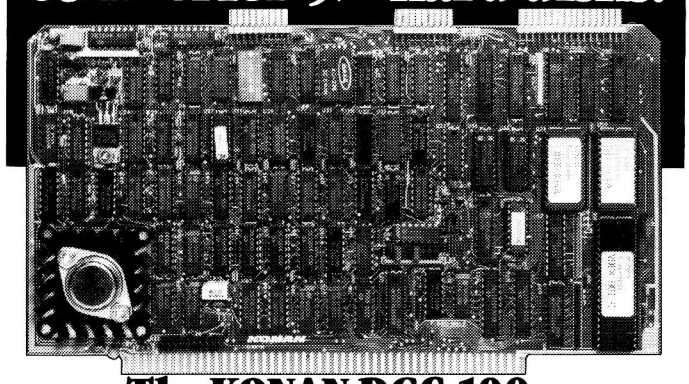

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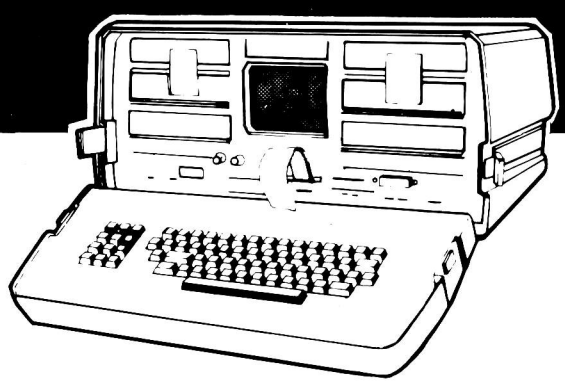

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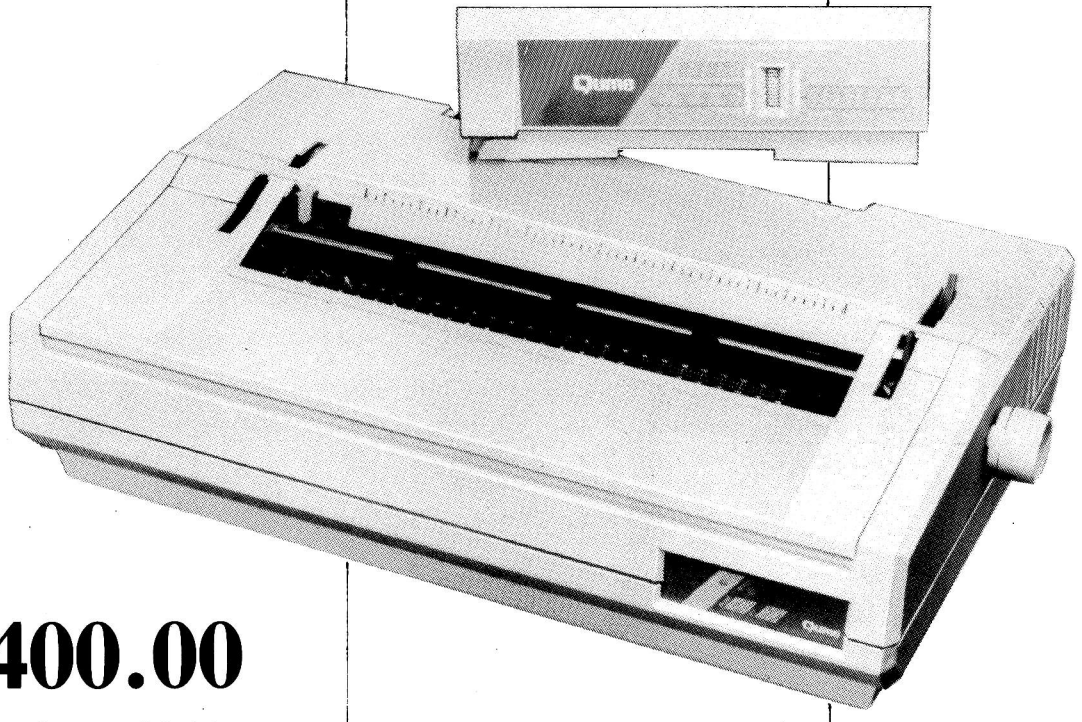

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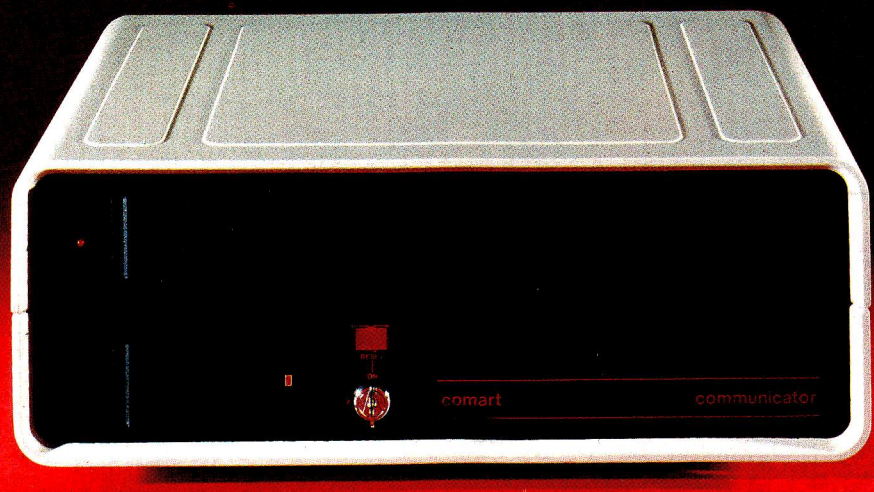

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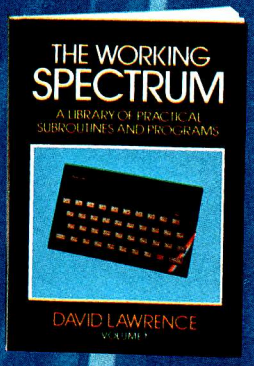

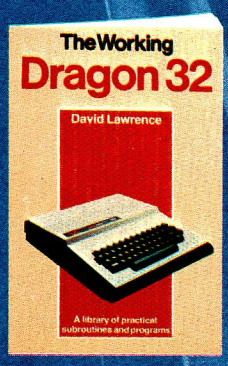

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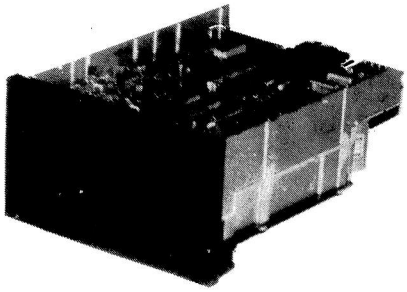

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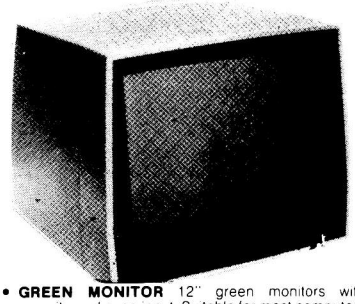

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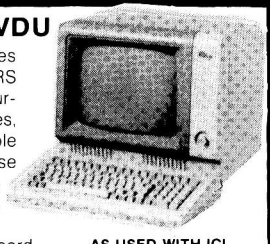

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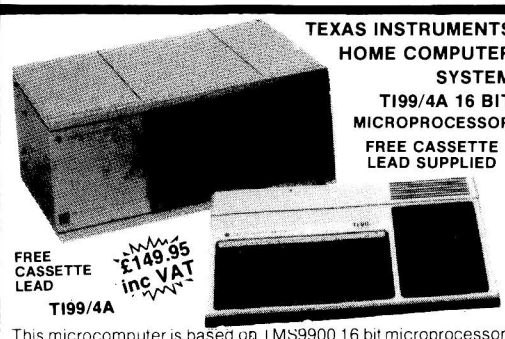

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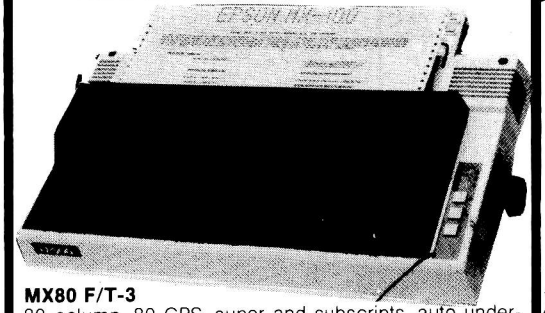

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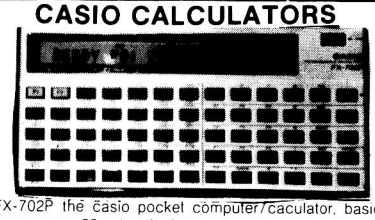

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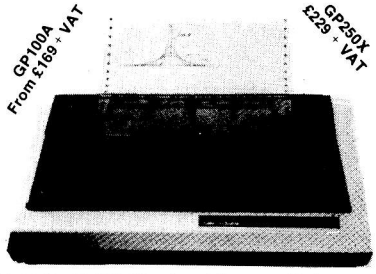

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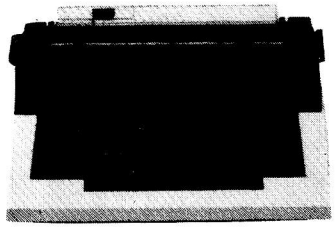

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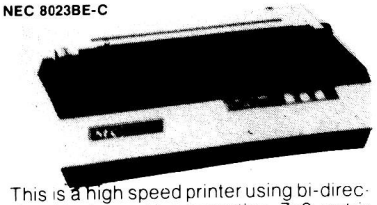

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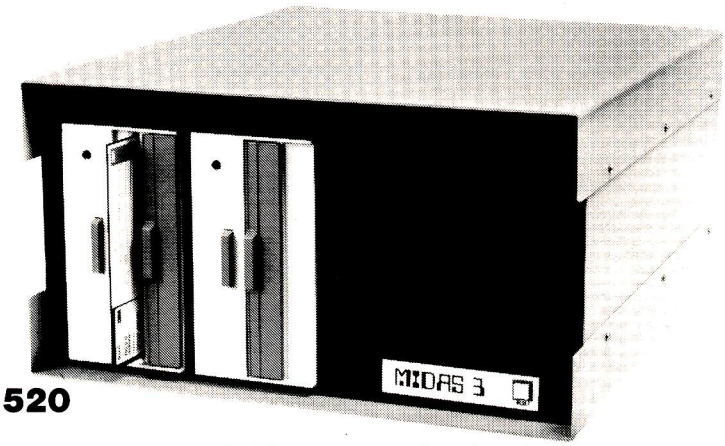

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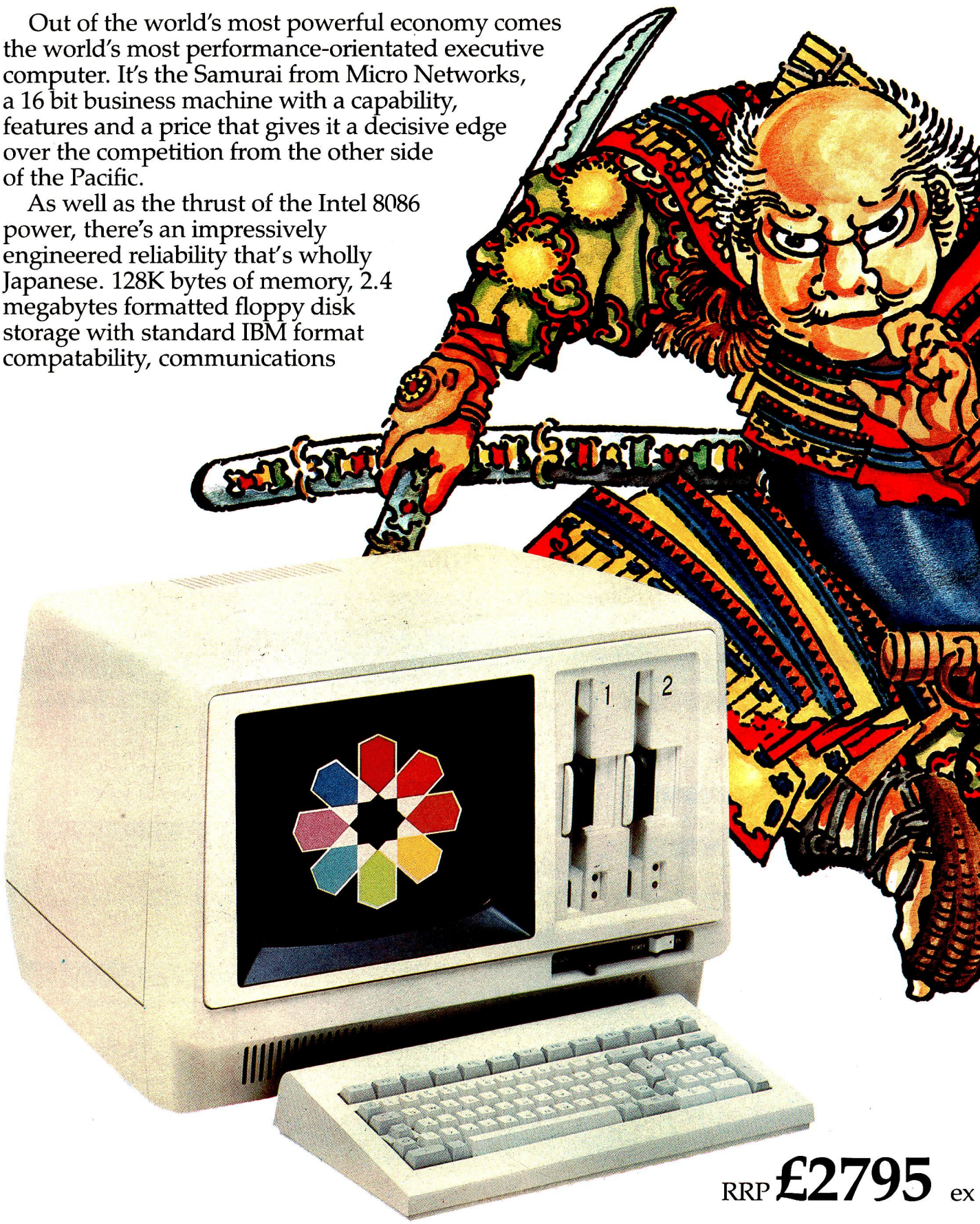

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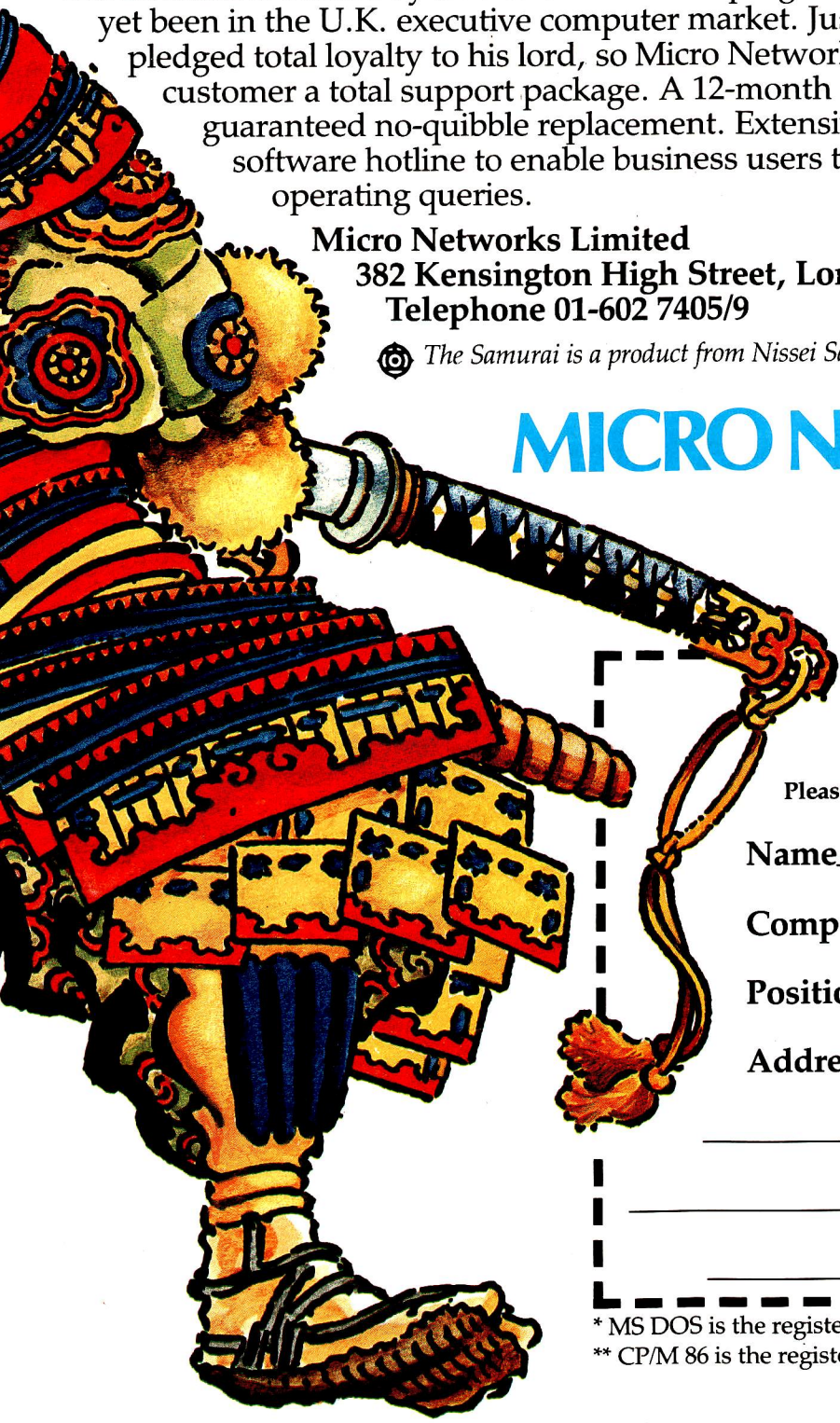

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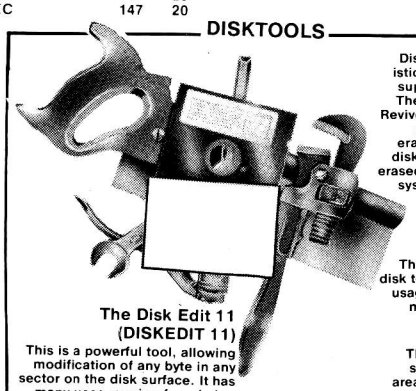

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Compal-80	Q2	Hewlett-Packard 125.8in	A1	Multi-Tech 1	Q2	Rade 1000 SSDD	RL
CPT 8000	A1	IBM PC-DOS SSDD	C1	Multi-Tech 2	Q2	Rade 1000 DSDD	RM
Cromemco System 3	A1	IBM PC-DOS DSDD	C2	Micromation	A1	Rair Black Box	RE
Cromemco System 2 SD/SS	R6	IBM CP/M-86 SSDD	C3	Micropolis Mod II	Q2	Research Machines 5.25in	RN
		IBM CP/M-86 DSDD	C4	Morrow Discus	A1	Research Machines 8in	A1
		ICL-PC	RE	Mostek	A1	Robotron 5"	N3
		ICL DRX Series	A1	Nascom (Gemini Drives SSSD)	R3	Robotron 8"	A1
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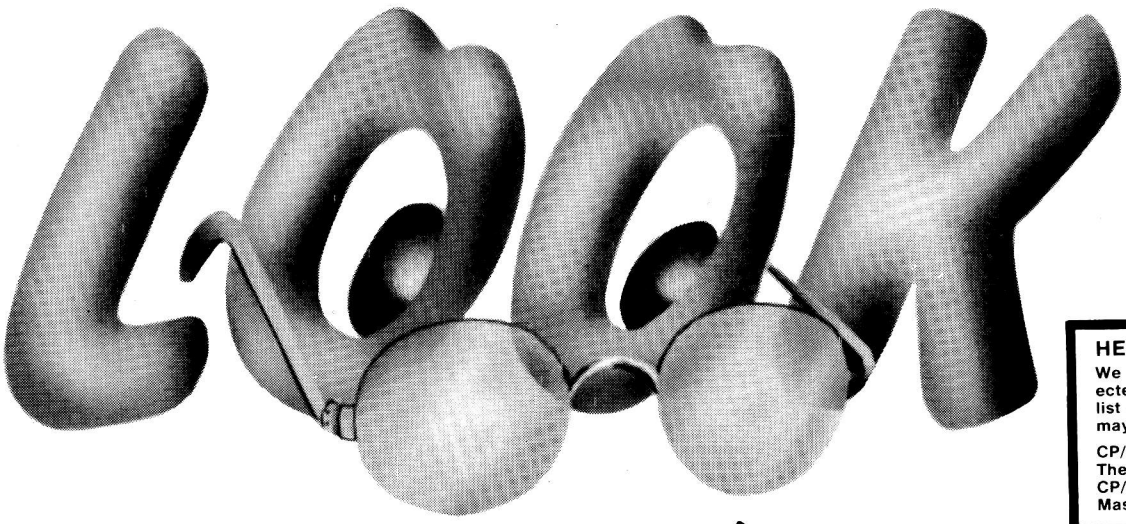

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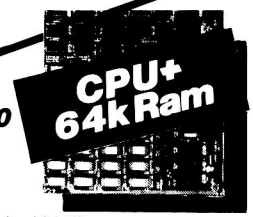

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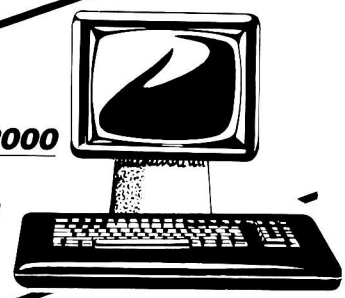

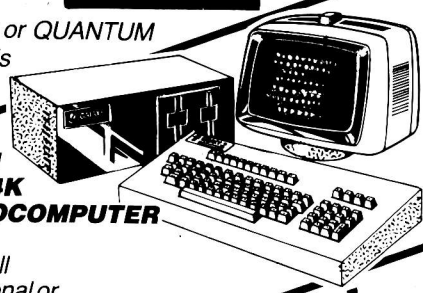

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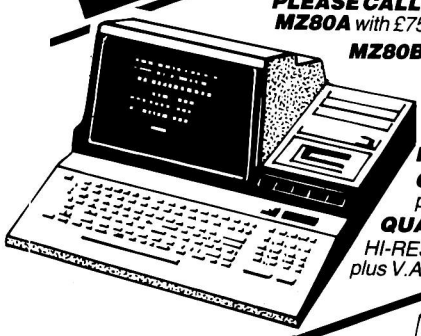

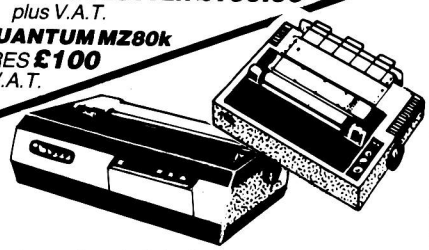

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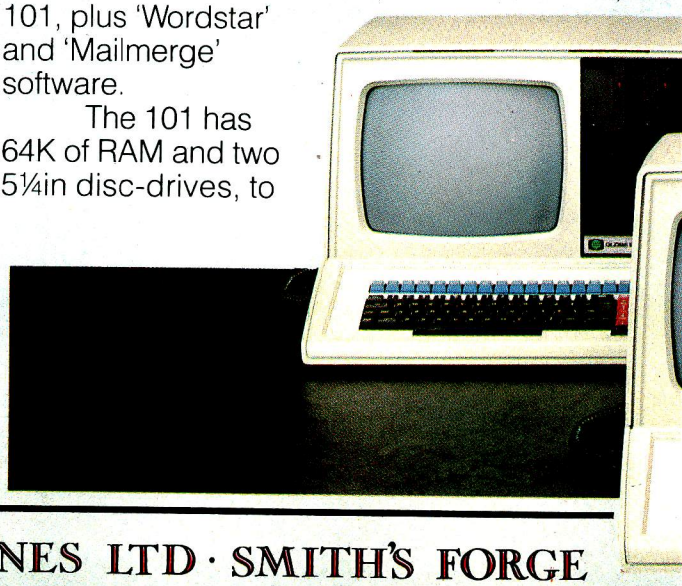

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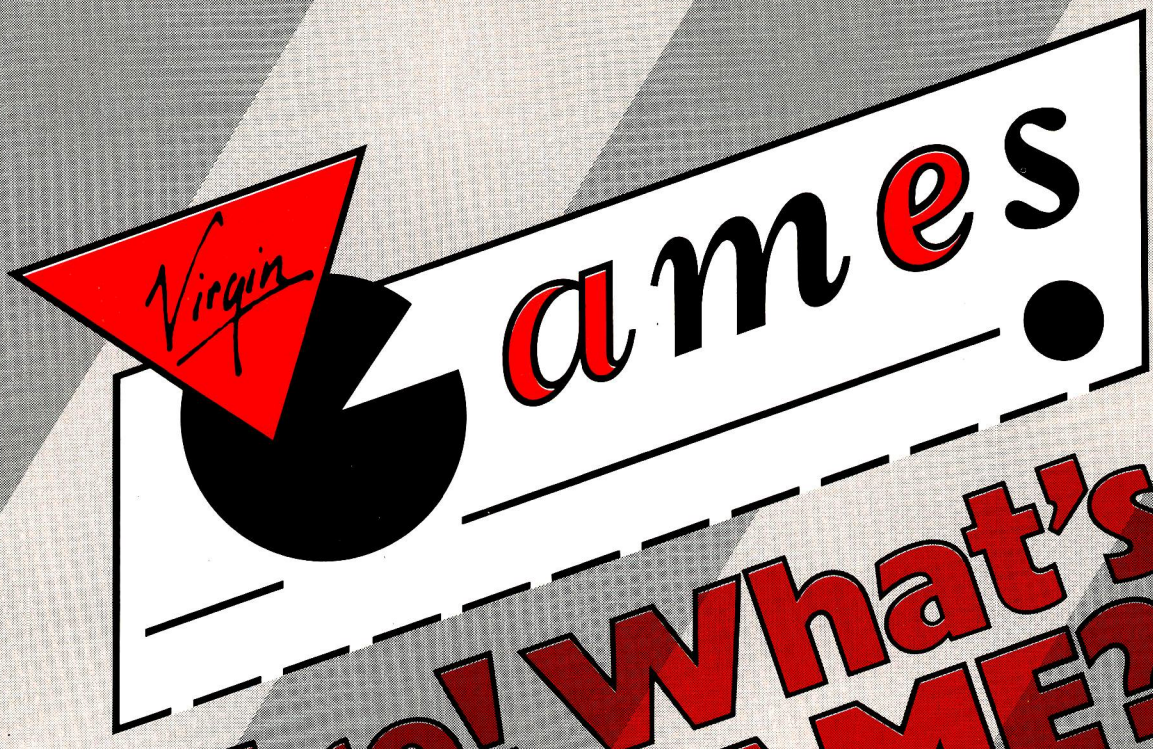

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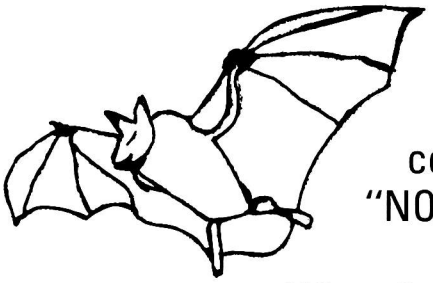

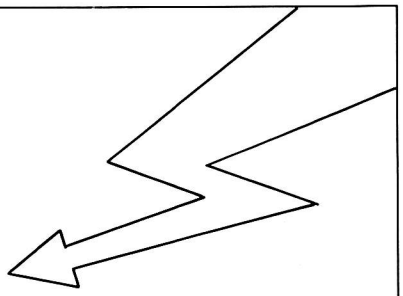

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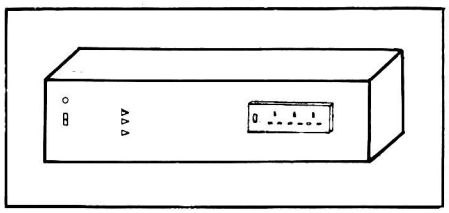

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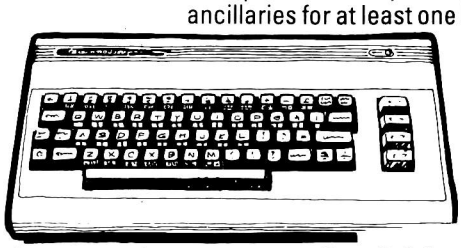

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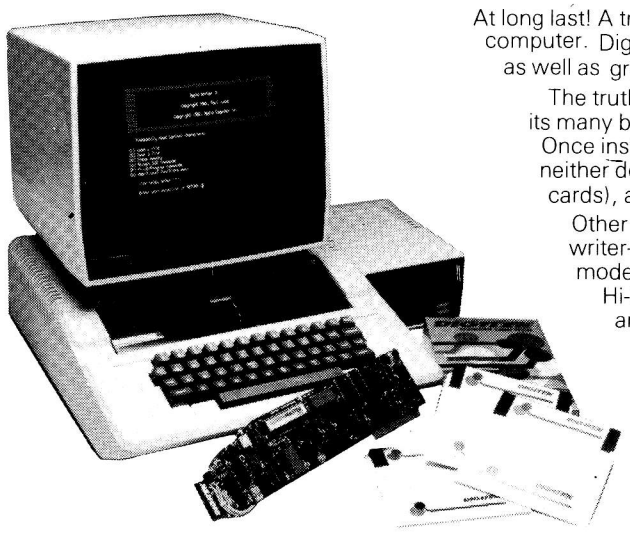

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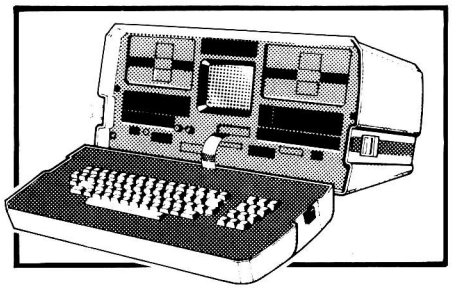

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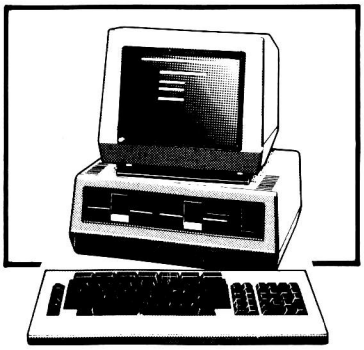

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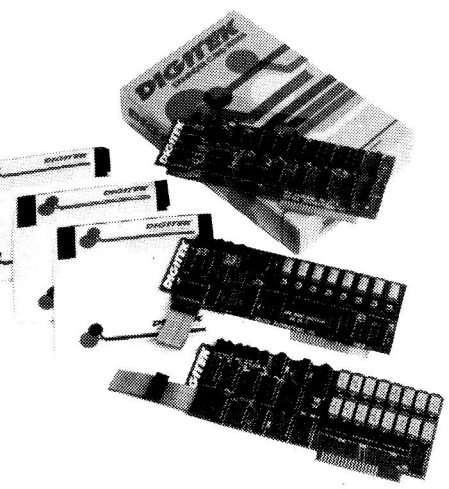
make your Apple blossom

RAMMASTER RANGE



More data storage, increased program capability — with Digitek's new range of plug-in Ram-Masters 16K, 64K, 128K, which use the latest low power D-Ram chips.

These Ramcards not only add extra memory to your Apple's standard 48K, but also make more efficient use of its existing memory by providing you with the advantage of loading alternative languages such as Pascal or Fortran, Memory management and Data Buffering for off-line printing (when used in conjunction with the new Super Printmaster III).

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To show you graphically the enormous capability of the Ram-Master range, every 64K and 128K Ramcard will have a demonstration program and a number of utility programs on disk, giving you versatility which no other Ramcard can provide.

Visicalc expand pre-boot disk and CP/M, Pascal Disk Emulators are available.

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Call in at your local Apple dealer or fill in the coupon — and let us make your Apple blossom.

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Screenmaster 80	£185	☐
Rammaster 16K	£85	☐
Rammaster 64K	£213	☐
Rammaster 128K	£319	☐
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TAKING THE COMPUTER A STEP FURTHER

EPSON HX20

Complete Hardware and software support. Stand alone or fully integrated into your existing system. Send S.A.E. for up to date software listing. Transam communications-editor-intelligent terminal software £45.00. Links HX20 into other computers as a portable terminal. Down load to cassette with off line editing/data capture.

CODE		PRICE
HX20UA	PORTABLE MICRO UNIT WITH OPERATING MANUAL	£402.00
	VINYL CASE	£9.00
HX20MC-SA	MICROCASSETTE DRIVE	£75.00
HX20EU-SA	EXPANSION UNIT	£80.00
H00BR-JA	BAR CODE READER	£82.00
HX20RC-SA	ROM CARTRIDGE	£45.00
H00AAU	SPARE MAINS ADAPTER	£8.50
SHX700	SENDATA ACOUSTIC COUPLER	£220.00
CAB 702	EXTERNAL CASSETTE CABLE	£5.70
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CAB 714	TERMINAL PRINTER CABLE	£15.00
CAB 716	LOCAL NETWORK CABLE HX20/HX20	£15.00
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A computer small enough to fit into a briefcase yet with a full size typewriter keyboard, LCD virtual screen, printer and microcassette facility actually built in. High speed serial communication with other computers plus the Epson reliability – a world beater.

A FULL SIZE QWERTY KEYBOARD WITH 68 KEYS INCLUDING 5 FUNCTION AND 13 SPECIAL KEYS. LCD DISPLAY WINDOW SHOWING ANY 20 COLUMN BY 4 LINE PART OF A VIRTUAL SCREEN UP TO 255 CHARACTERS WIDE. 50 HOURS BATTERY LIFE WITH MAINS ADAPTER FOR OVERNIGHT CHARGING. BUILT IN PRINTER 5 x 7 MATRIX, 24 COLUMN WITH BIT ADDRESSABLE GRAPHICS. OPTIONAL BUILT IN MICROCASSETTE OR ROM PACK.

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PC 1500 COMPUTER	£147.78
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You thought it would never arrive, but here it is with all those promises fulfilled. We never appreciated the full computing potential of the NEWBRAIN but suffice to say, it's a machine with a great future. We'll be able to tell you how to fully utilize the considerable power of the NEWBRAIN and take advantage of all that CP/M software.

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An executive tool for the man in a hurry. 600 appointments can be held in memory. Never miss a board meeting or a birthday. In addition, – an impressive scientific aid to engineers and Scientists with magnetic card strips for handy programs and a magnificent BASIC.

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For full proposed range of Portable Computers and typewriters, including the Osborne, Kaypro II, Teleram, Panasonic, Toshiba, and NEC please contact us for price and availability. Not all items are yet in production so it is best to telephone for delivery details.

Value - MicroValue - Micro

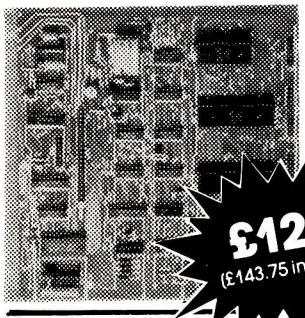
80-BUS MULTIBOARDS

The Gemini Multiboard Microsystem provides a large and growing range of fully compatible microcomputer boards. Around these boards you can configure a solution to satisfy your own particular microprocessor needs, whether you need as many as 10 boards or as few as one. This flexibility is made possible by Gemini's adoption of a number of accepted industrial standards; especially the 80-BUS, specifically designed for the Z80A

The Z80A (the high speed version of the Z80) is now the largest selling microprocessor worldwide, and forms the heart of the MultiBoard system. The principal advantage of a Z80A based system is the abundance of software that is available, and the majority of those packages operate under the CP/M disk operating system. With CP/M software becomes machine independent; providing the user with literally the widest range of software available.

With MultiBoard an almost unlimited number of system permutations are possible. Seven of the most popular boards are shown here, but there is a range of 15 available from your MicroValue dealer; together with mother boards, frames, cables, power supplies, keyboards and compatible software if required.

Your MicroValue dealer can advise you on suitable permutations to suit your requirements, whether building a system from scratch or expanding your Galaxy or Nascom computer.



GM 816 — MULTI I/O Board

- ★ Six 8-Bit I/O Ports
- ★ 4 Counter/Timer Channels
- ★ Real Time Clock
- ★ Further expansion capability

Daughter boards also available for further expansion.

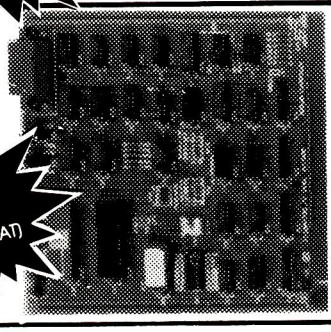
£125 (£143.75 inc. VAT)

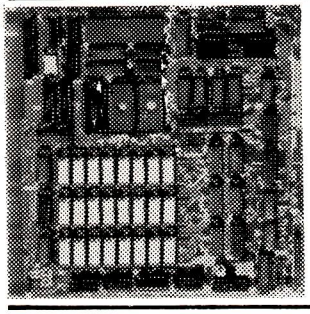
EV 814 — IEEE 488 Controller

- ★ Cost-effective Controller
- ★ Comprehensive software supplied

Controls equipment fitted with IEEE488 or GP1B interface.

£140 (£161.00 inc. VAT)

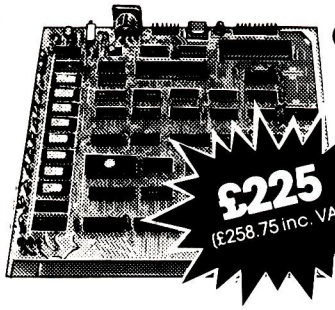




PLUTO — Colour Graphics Processor Board

- ★ 640 x 576 Bit mapped display
- ★ On-board 16-Bit microprocessor
- ★ Comprehensive on-board software

IO 828 A:	IO 828 B:
192K RAM "PLUTO" **£399**	"BABY PLUTO" 96K **£299**
(£458.85 inc. VAT)	(£343.85 inc. VAT)



GM813 — CPU/64K RAM Board

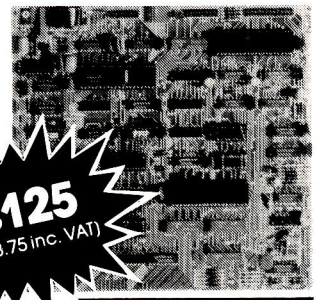
- ★ 4 MHz Z80A CPU
- ★ 64K Dynamic RAM
- ★ RS232 Serial Interface
- ★ Two 8-Bit I/O Ports
- ★ 1200 Baud Cassette Interface
- ★ Extended and Page Addressing Modes

£225 (£258.75 inc. VAT)

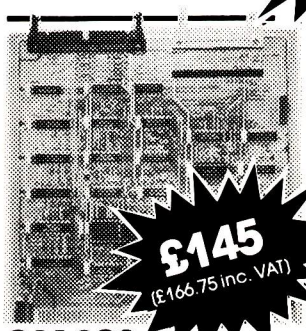
The Gemini GM813 is an 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 — CPU Board

- ★ 4MHz Z80A CPU
- ★ Four 'Bytewide' Memory Sockets
- ★ Two 8-Bit Input/Output Ports
- ★ 8 Bit Input Port
- ★ RS232 Serial Interface
- ★ 1200 Baud CUTS Cassette Interface



£125 (£143.75 inc. VAT)



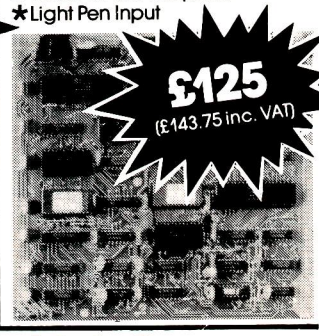
GM812 — IVC Board

- ★ 80x25 Display Format
- ★ On-board Z80A Microprocessor
- ★ Buffered Keyboard Input
- ★ Programmable Character Generator
- ★ 160x75 Pixel Graphics
- ★ Light Pen Input

£145 (£166.75 inc. VAT)

GM 829 — FDC/SASI Board

- ★ Single/Double density operation
- ★ Single/Double sided drive operation
- ★ Up to 4 mixed 3.5", 5.25" and 8" drives
- ★ Industry Standard SASI hard-disk interface



£125 (£143.75 inc. VAT)

Other boards available in the Multiboard range include:

GM802	64K Dynamic RAM Board	**£125** (£143.75 inc. VAT)
GM803	EPROM/ROM Board	**£65** (£74.75 inc. VAT)
MP826	32K Static RAM Board	**£185** (£212.75 inc. VAT)

All MultiBoards are Nasbus* compatible
Ask for latest catalogue for full details.

*Trademark of Nascom Microcomputers Division of Lucas Logic

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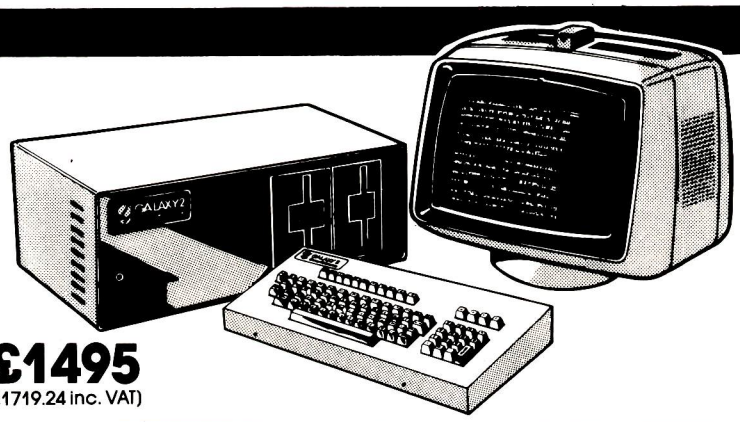
COMPUTERS

New from Gemini

Gemini Galaxy 2

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included



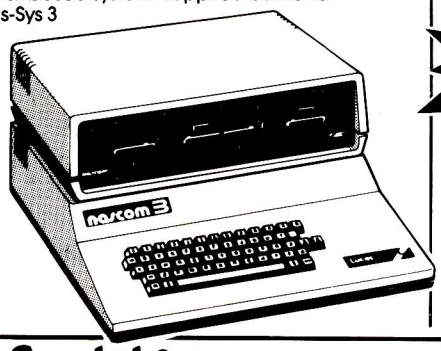
£1495
(£1719.24 inc. VAT)

Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.

48K System
£549 (£631.35 inc. VAT)
CP/M 2.2
£100 (£115 inc. VAT)
NASCOM 2 KIT
£225 (£258.75 inc. VAT)
Built & Tested
£285 (£327.75 inc. VAT)



80x25 Video for nascom

£125
(£143.75 inc. VAT)

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

Nascom 1 Printed Circuit
(inc. parts list)
£25 (£28.75 inc. VAT)

GM802 64K RAM Card **£125** (£143.75 inc. VAT)

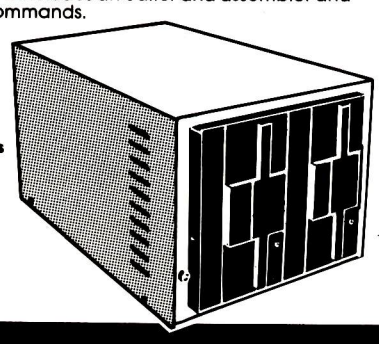
GM802K 16K RAM Kit **£80** (£92 inc. VAT)

Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers.
An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£350 (£402.50 inc. VAT)
Dual Drive System
GM825-2S
£575 (£661.25 inc. VAT)
CP/M2.2 Package
(GM 5 3 2 for Gemini)
£90 (£103.50 inc. VAT)

POLYDOS 4
for Nascom
£90 (£103.50 inc. VAT)
GM809 Disk Controller Card
for 8" and 5.25" drives
£125 (£143.75 inc. VAT)
GM829
for 8", 5.25" and Winchester Drives
£145 (£166.75 inc. VAT)



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- ★Rodime Drive
- ★Industry Standard SASI interface
- ★Integral Controller and power supply

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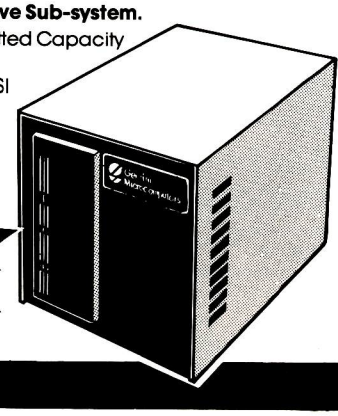
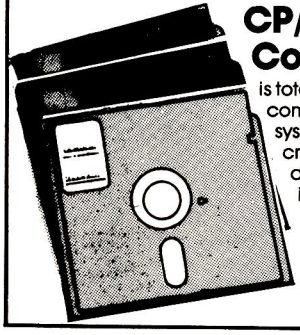


SOFTWARE



CP/M Software Compas

is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

£120
(£138 inc. VAT)

'The Last One' is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.
£330 (£379.50 inc. VAT)
***MBASIC**–MicroValue Price if purchased with 'The Last One' **–£178.95 inc.VAT**

VIZ:APL is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.
£255 (£293.25 inc. VAT)

Gemini Software:

GEM PEN Text Editor	**£45**	(£51.75 inc. VAT)
GEM ZAP Assembler	**£45**	(£51.75 inc. VAT)
GEM DEBUG Debugging Utility	**£30**	(£34.50 inc. VAT)
WORDSTAR Word Processor	**£215**	(£247.25 inc. VAT)
GEM GRAPHIC Links with MBASIC	**£35**	(£40.25 inc. VAT)

A wide range of software for Nascom also available.
When ordering disks, please specify format.

Value - MicroValue - Micro

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* 32K RAM
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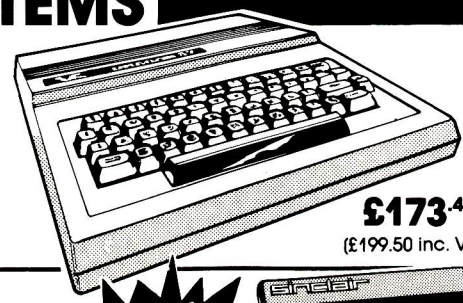

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a real computer for less than £50!

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for ZX81
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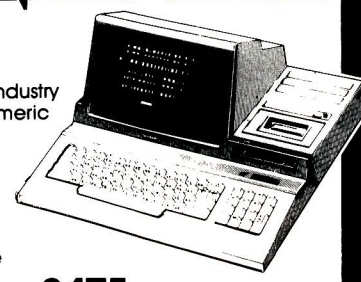
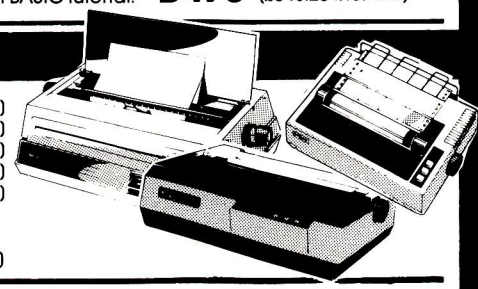


FREE SOFTWARE!
Home budget, bank reconciliation, SPACE INVADERS, STAR TREK, SCRAMBLE, bank loan calculator, mortgage calculator + 7 other games.
Educational—Geography, Maths., Spelling + 4 part BASIC tutorial.

£475 (£546.25 inc. VAT)

PRINTERS



Epson MX80 Type III	**£348** (£399.95 inc. VAT)
Epson MX80 FT Type III	**£388** (£445.95 inc. VAT)
Epson MX100 Type III	**£496** (£569.95 inc. VAT)
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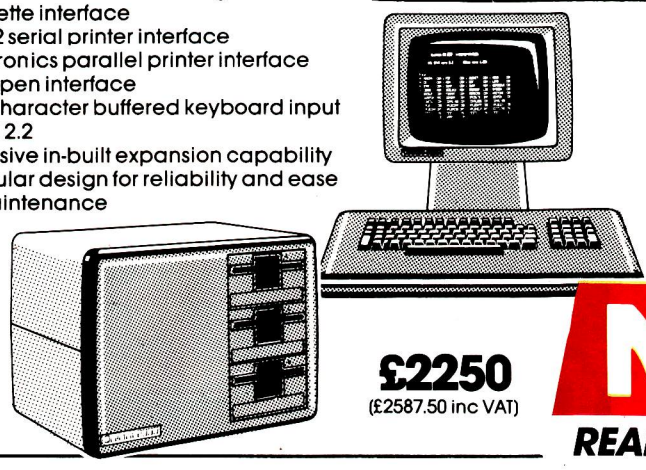
Daisy Wheel Printer:

Smith-Corona TP-1 **£485** (£557.75 inc. VAT)

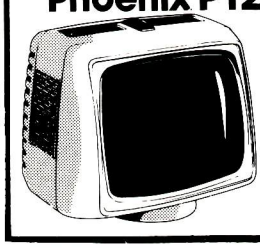
Quantum QM 2000 COMPUTER SYSTEM

* Twin Z80A Microprocessors
* 64K Dynamic RAM
* 2.4 megabytes of formatted disk storage capacity
* 80 × 25 screen format
* 160 × 75 pixel graphics
* Programmable character generator
* Cassette interface
* RS232 serial printer interface
* Centronics parallel printer interface
* Light pen interface
* 128 Character buffered keyboard input
* CP/M 2.2
* Extensive in-built expansion capability
* Modular design for reliability and ease of maintenance



£2250
(£2587.50 inc VAT)

Phoenix P12 Monitor



A high quality data display monitor, ideal for all Nascom and Gemini systems.
20MHz resolution.
Available in amber or green phosphor.

£110
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Tel: 021-622 6436

BRISTOL
Target Electronics Ltd., 16 Cherry Lane.
Tel: (0272) 421196

COLCHESTER
Emprise Electronics Ltd.,
58 East Street.
Tel: (0206) 865926

EGHAM, SURREY
Electrovalue Ltd.,
28 St. Judes Road, Englefield Green.
Tel: (07843) 3603

IPSWICH
MDW (Electronics),
47/49 Woodbridge Road East.
Tel: (0473) 78295

LONDON W2
Henry's Radio, 404 Edgware Road.
Tel: 01-402 6822

LONDON SW11
OFF Records,
Computer House, 58 Battersea Rise,
Clapham Junction.
Tel: 01-223 7730

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EV Computing, 700 Burnage Lane.
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Computerama, (Skytronics Ltd.)
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MicroValue

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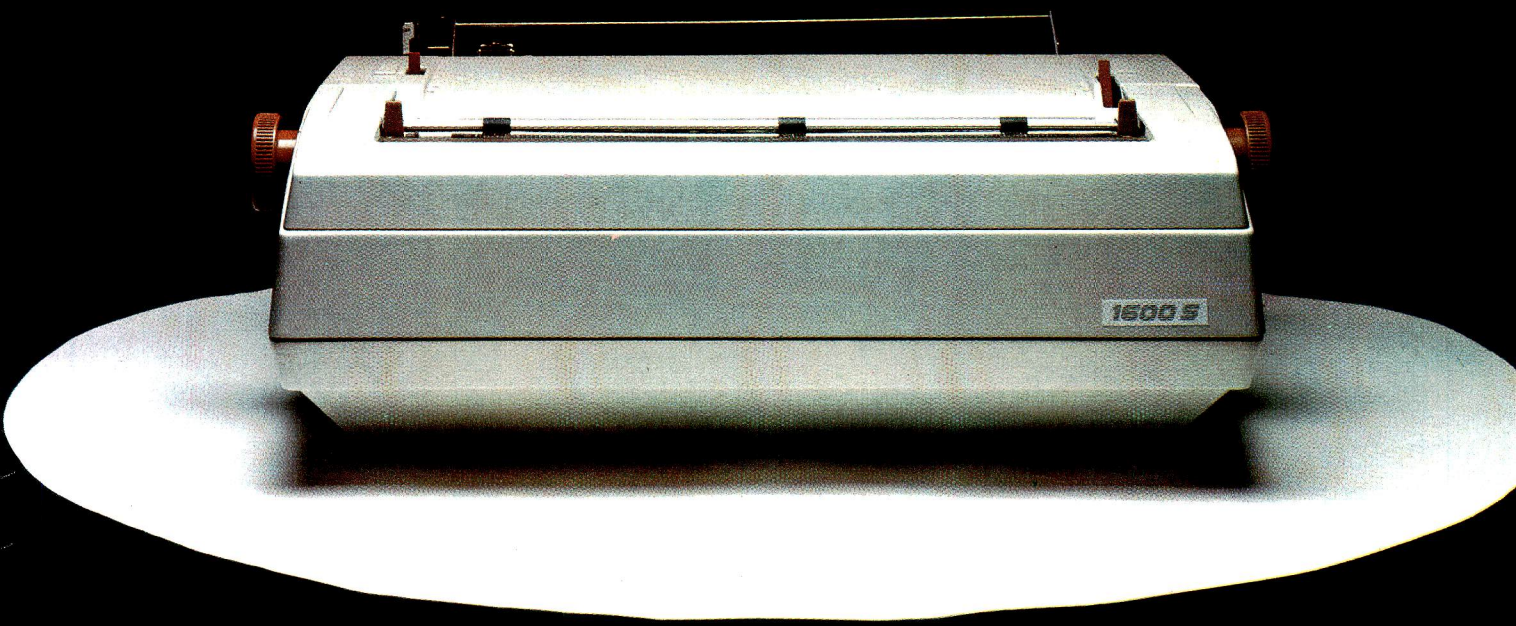
THE BEST SELLER OF 1982



In 1982 the RICOH 1600S outsold every other comparable printer because of its speed, reliability, intelligence, flexibility and sophistication.

Because it is compatible with all known systems and software packages.

Because of the 12 month warranty that Micropute offer.

Because Micropute are a company who care, who are constantly aware of changing needs and who can fulfill any special requirements.

Not least of all, because of the price

In 1983, there will be thousands more satisfied customers. We hope that you will be one of them.

ONLY MICROPUTE GIVE YOU SUPERCOVER

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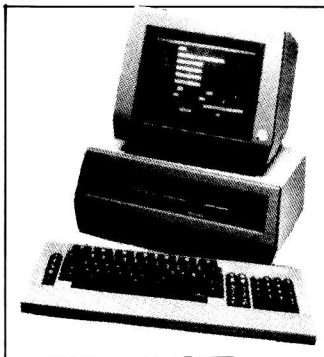

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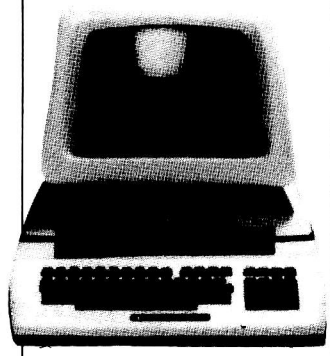

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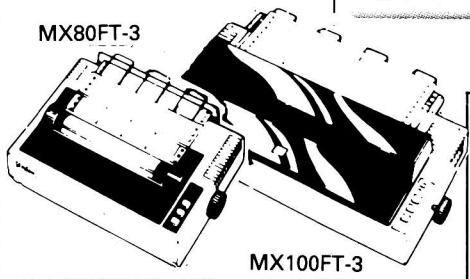

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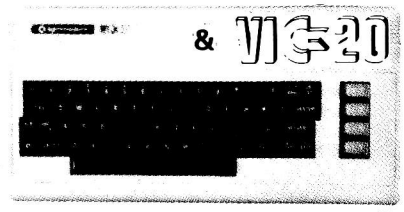

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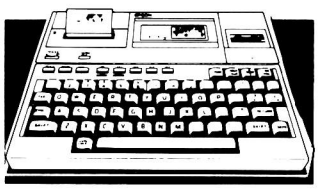

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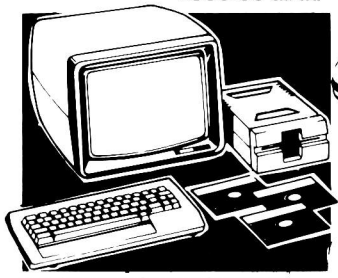

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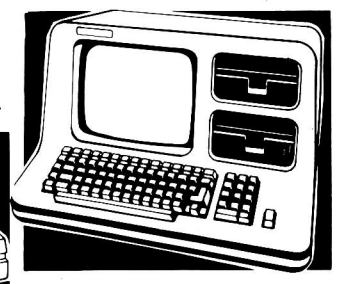

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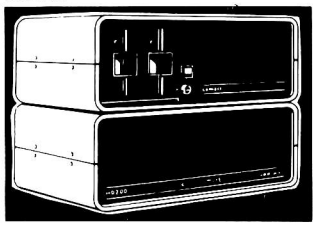

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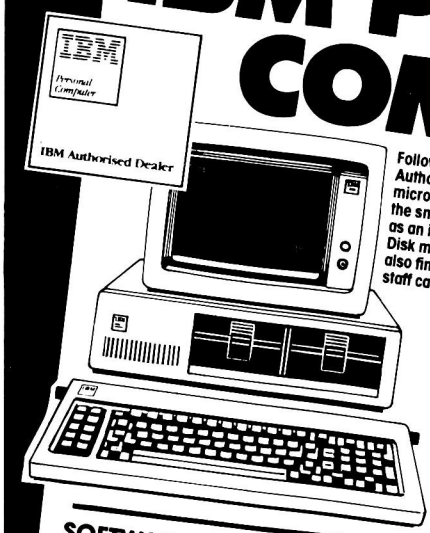

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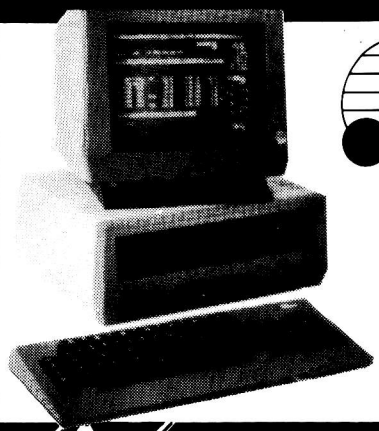

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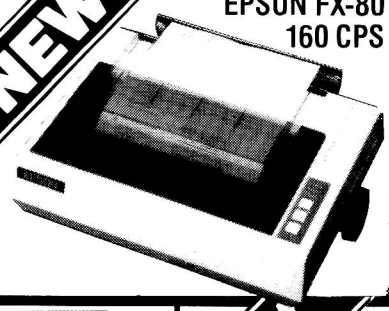

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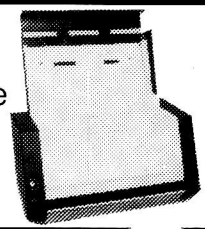

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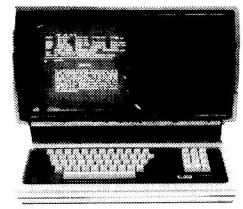

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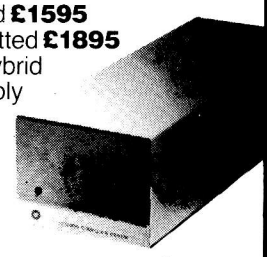

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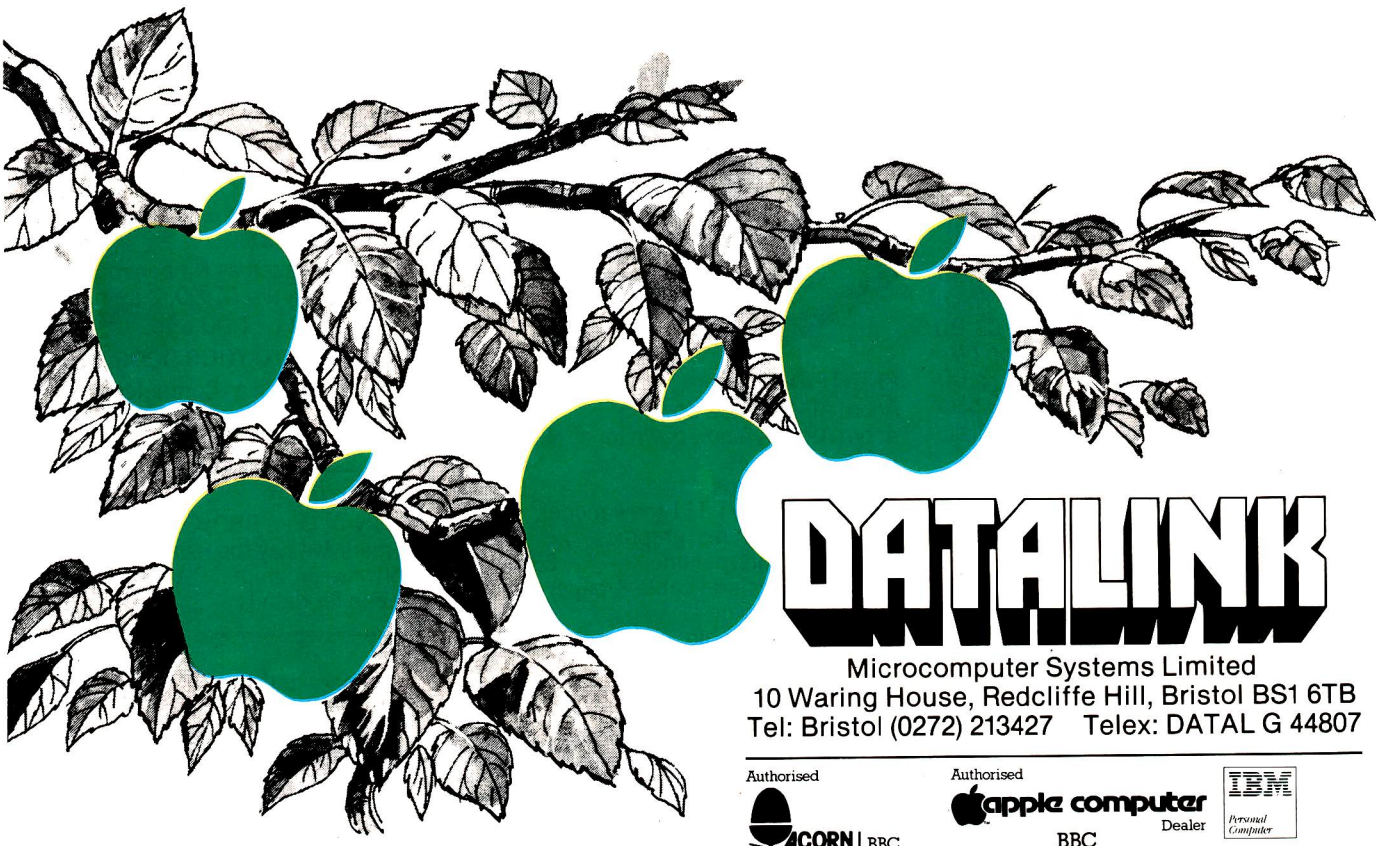

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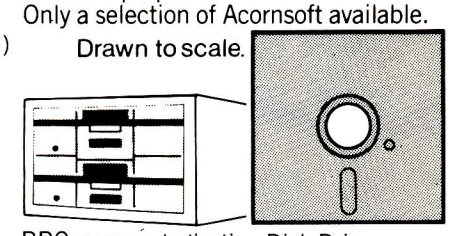

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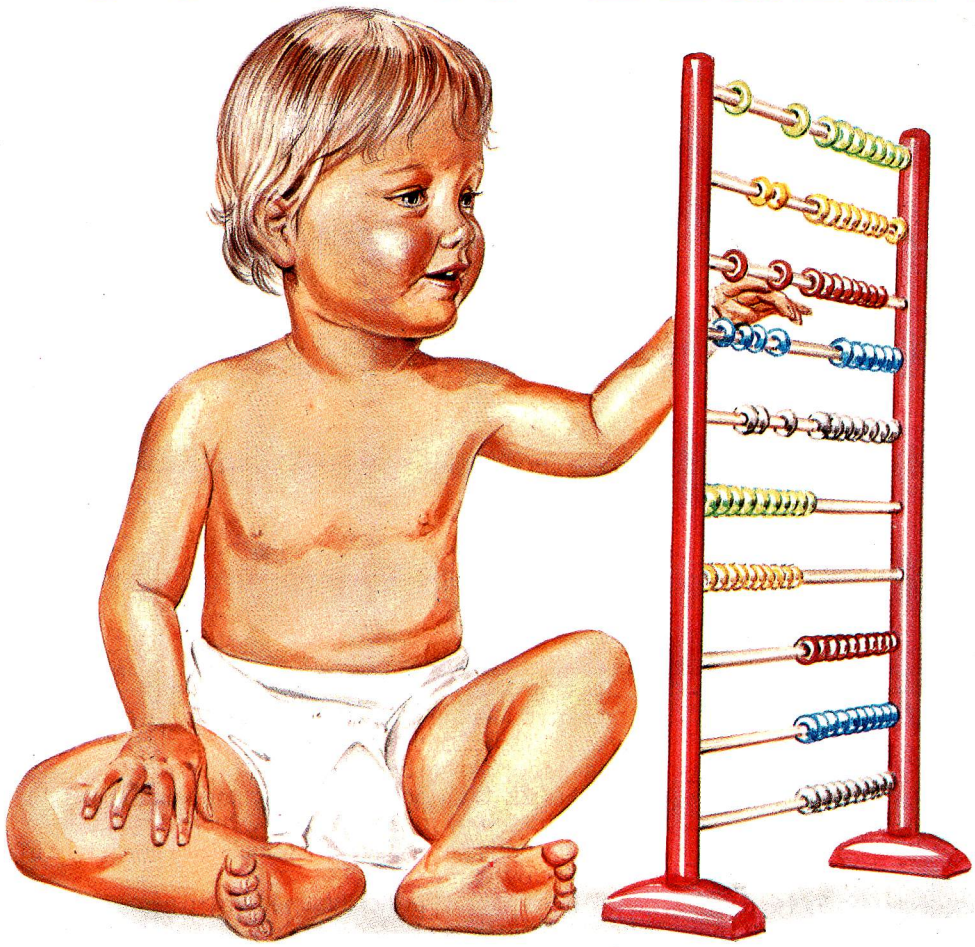

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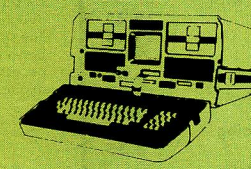

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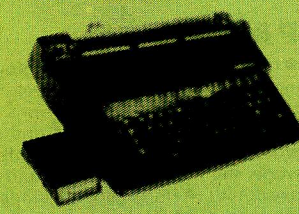

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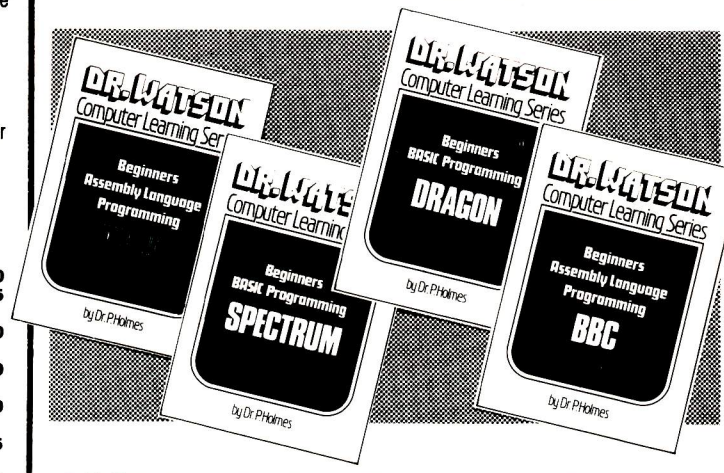

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Which Micro & Software Review's side-by-side tests reveal other surprises too. Would you have thought that the Cambridge Lynx would slay the Welsh Dragon 32? Better read the test.

We also line up the ageing VIC 20 against the upstart Oric I. A real clash!

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nursery slopes of programming and into areas with a touch of sophistication, using time-savers like letter variables and character statements.

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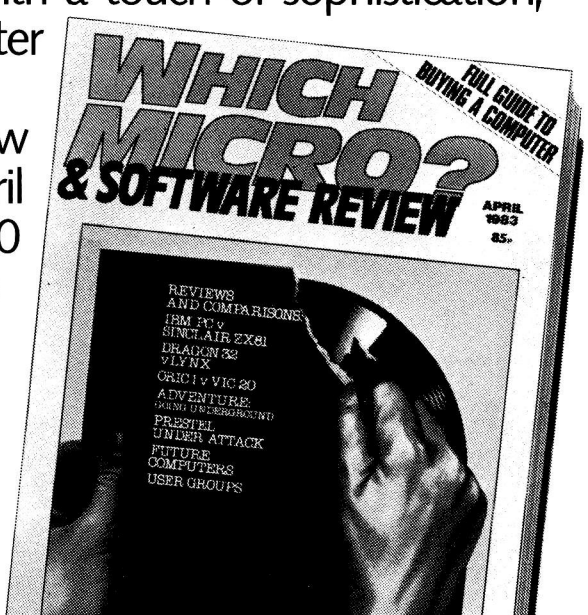

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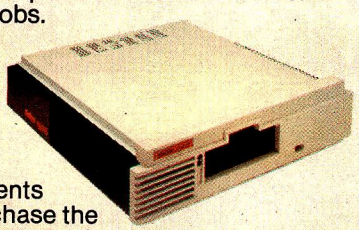

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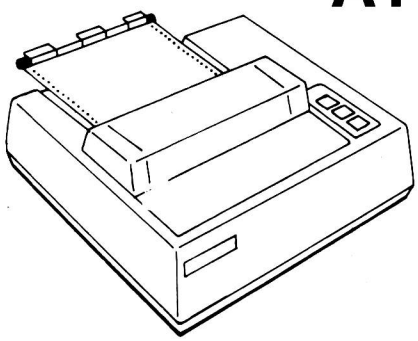

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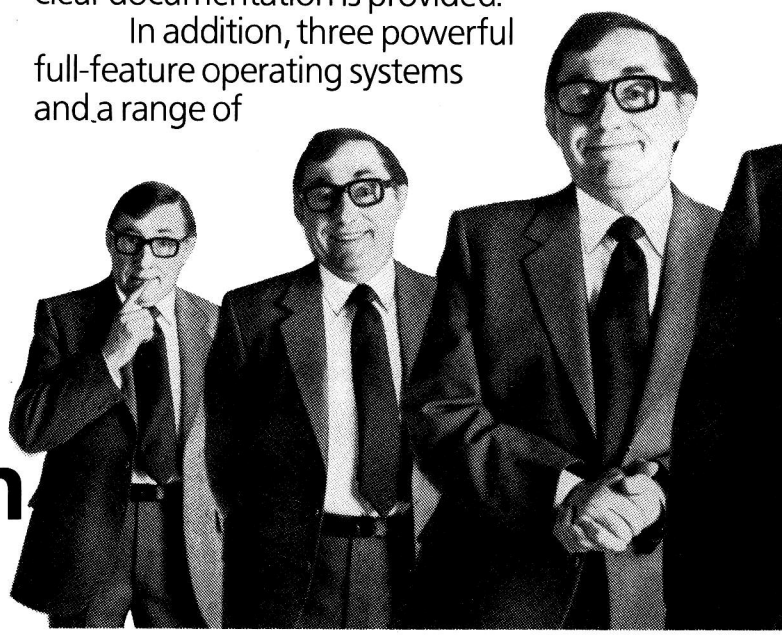

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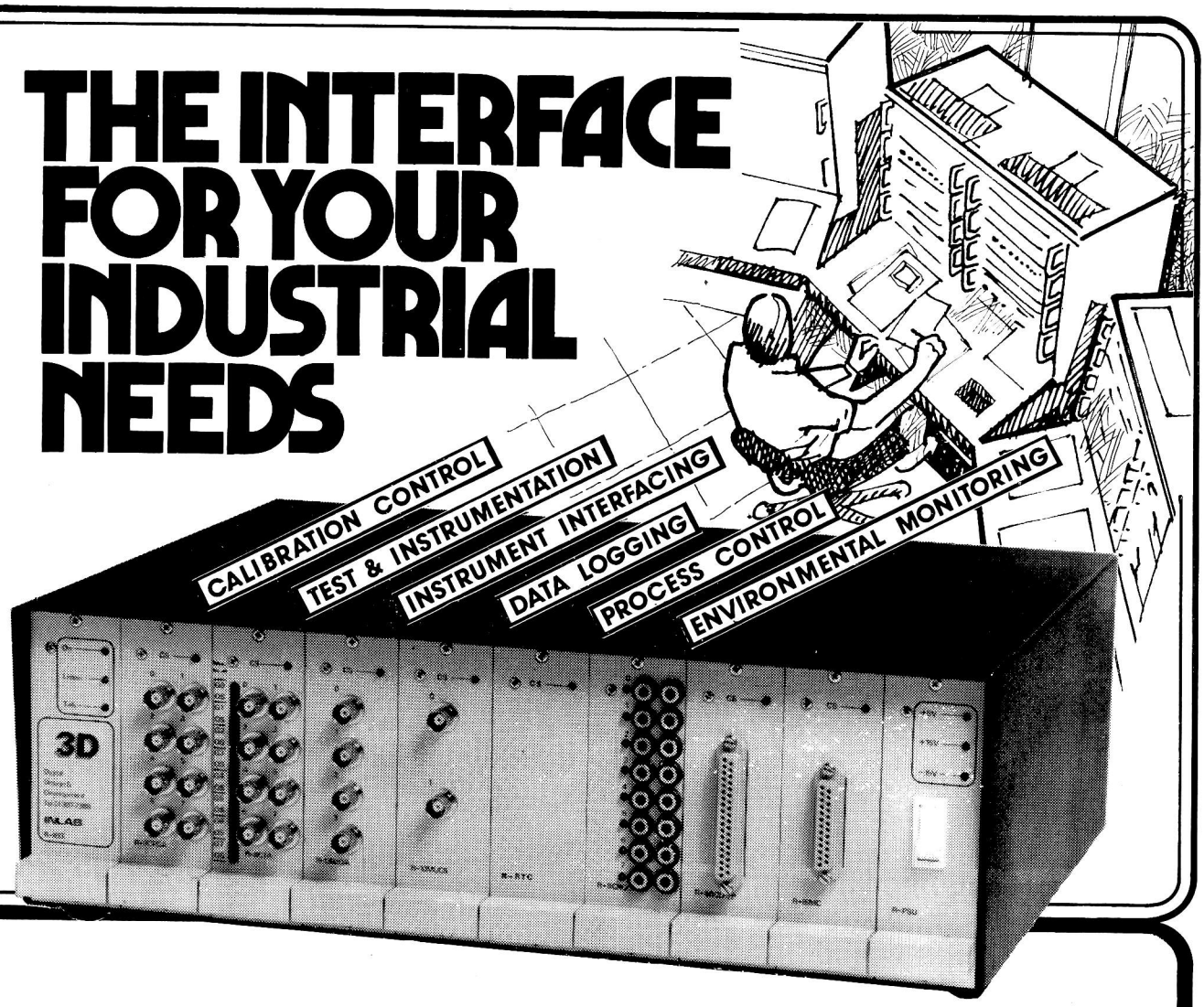

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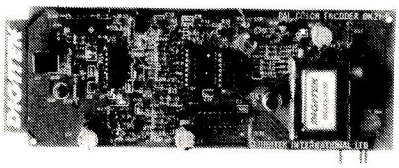

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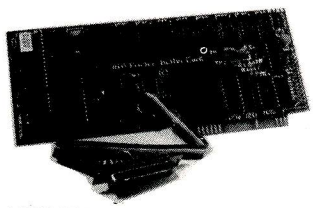

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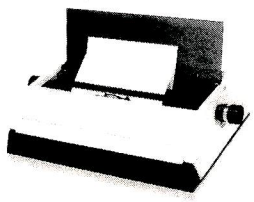

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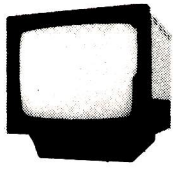

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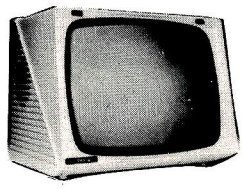

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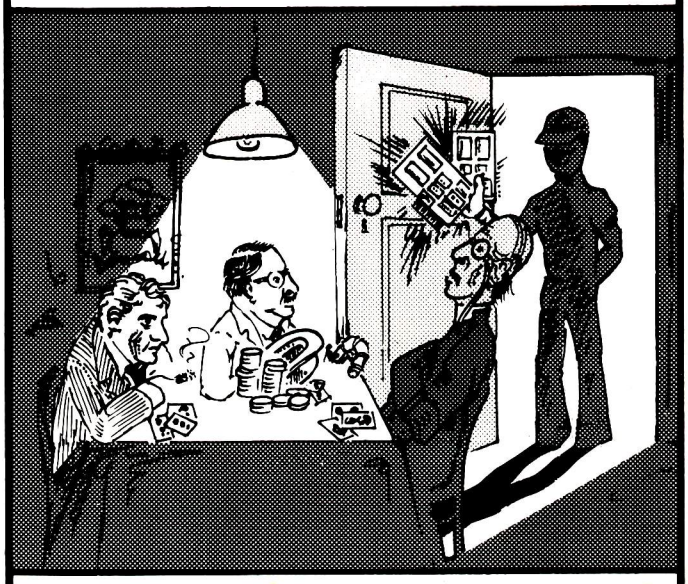

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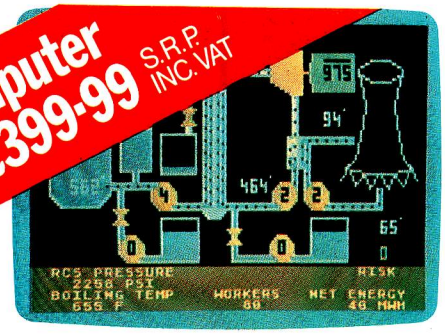

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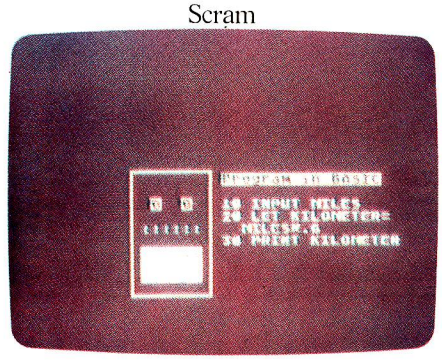

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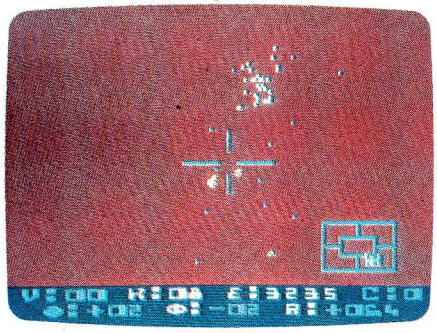

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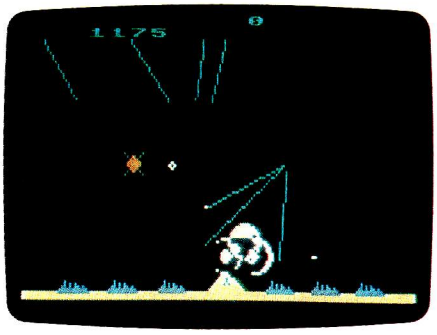

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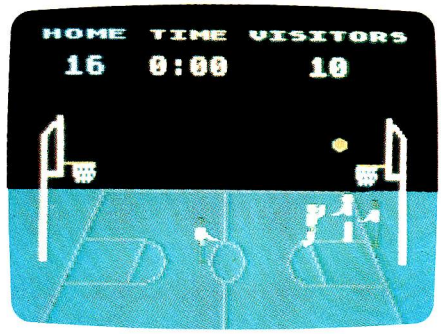

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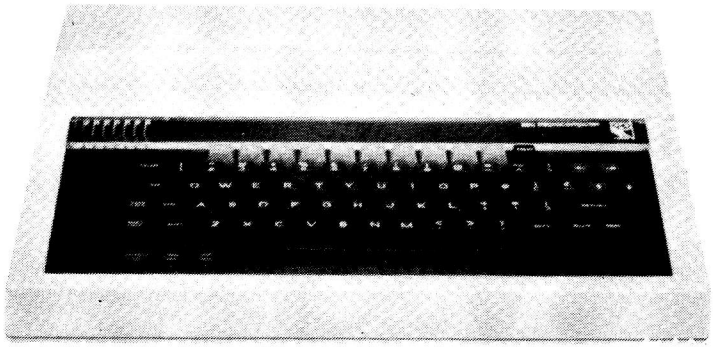

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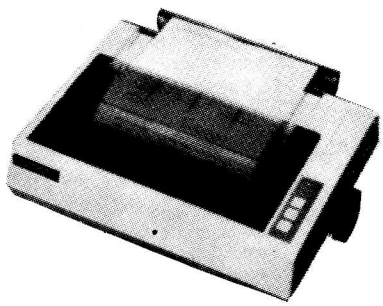

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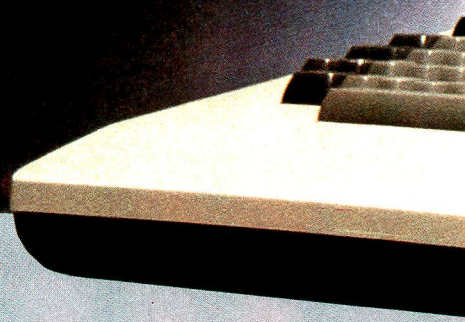

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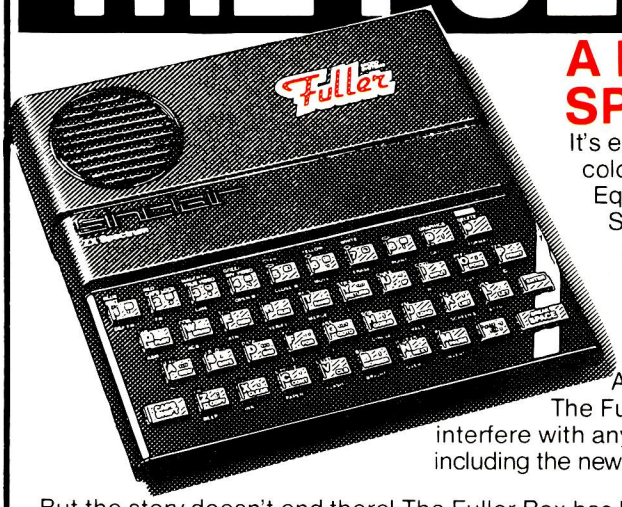

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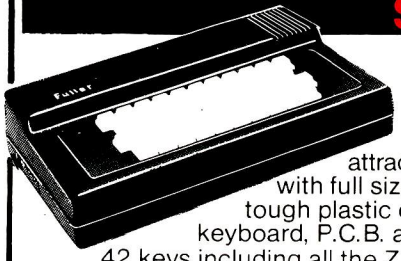

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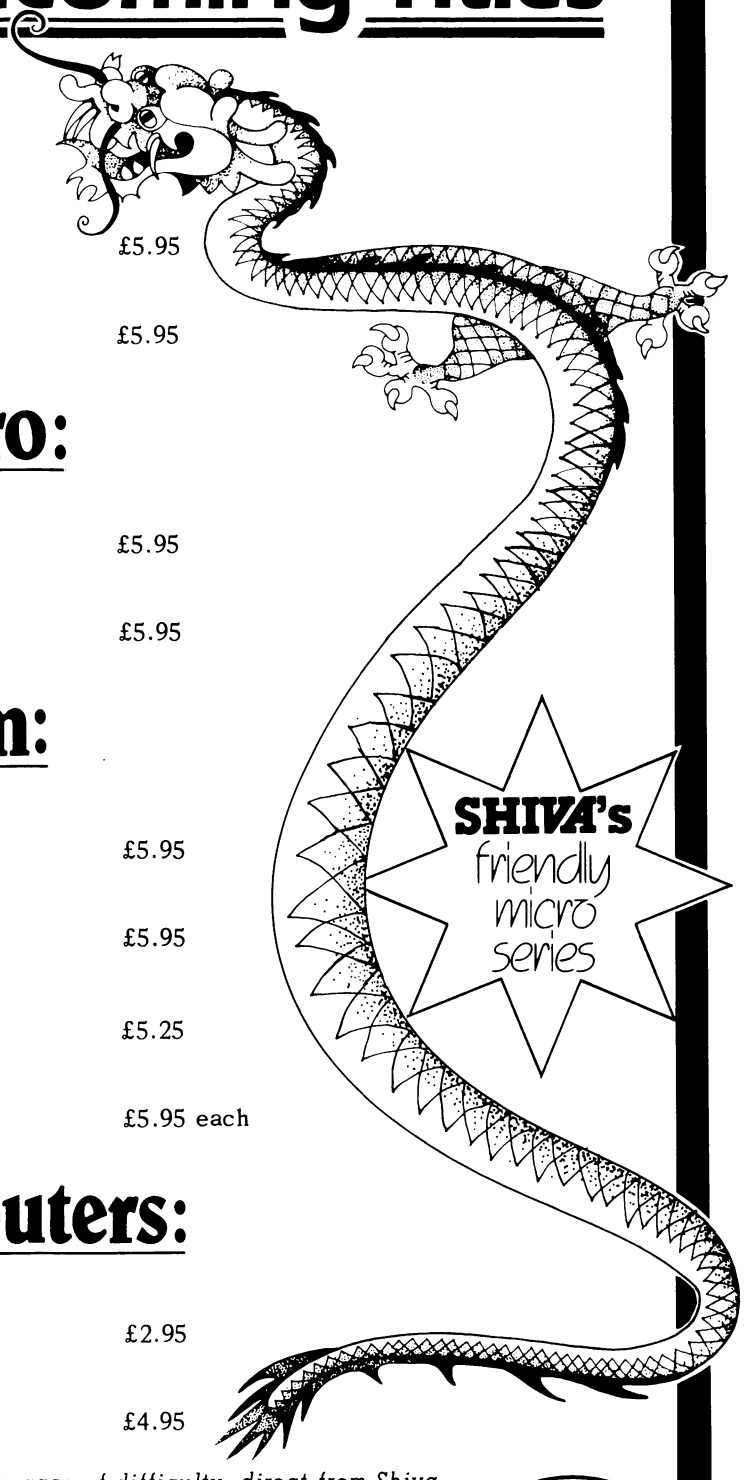

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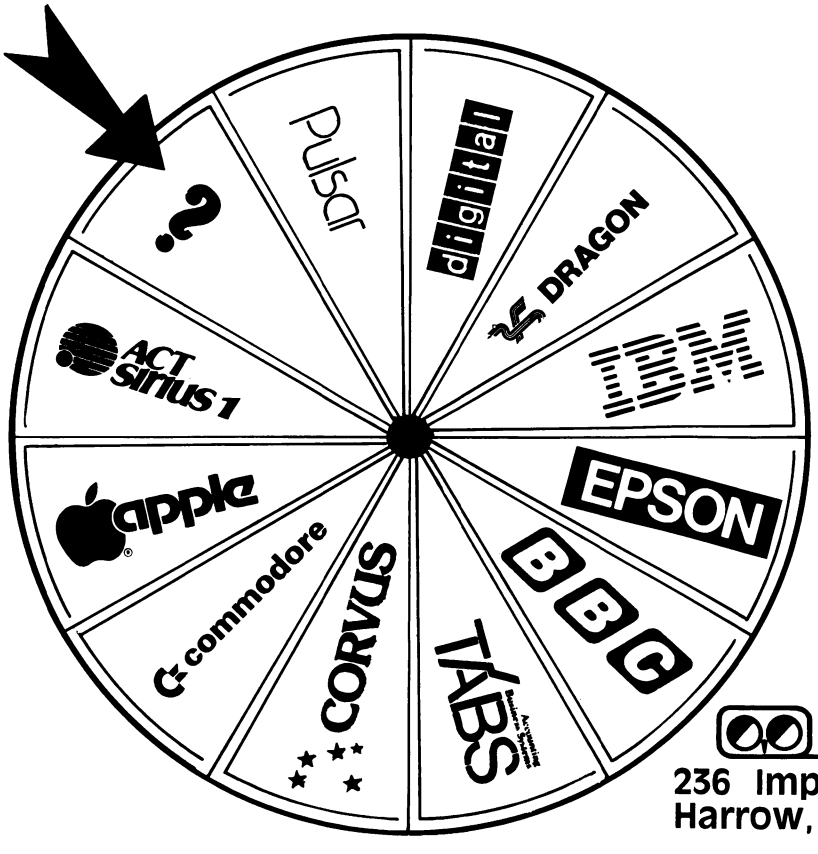

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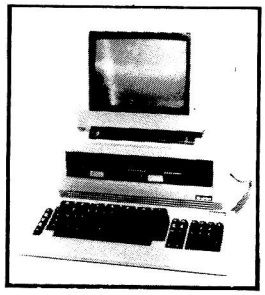

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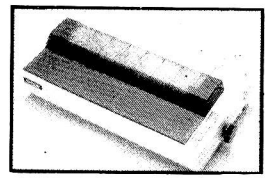

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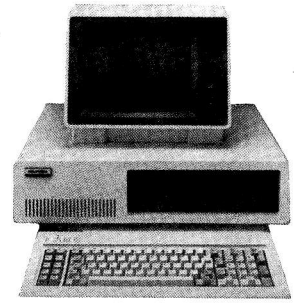

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Microprocessor	16-Bit 8088 8-Bit Z-80 (Opt)	16-Bit 8088	?
USER Memory	128K-1 Mbytes	18K-256 Kbytes	?
IBM-PC Compatible Expansions Slots Beyond Professional Configuration[1]	8 Slots	0	?
Resident Floppy Disk Storage	Dual 320K (std)	Dual 160K (Opt) Dual 320K (Opt)	?
Resident Cache Buffer Hard Disk Storage	5M/10M	–	?
OPTIONAL OPERATING SYSTEMS (Supported by Company)[2]			
MS-DOS (PC-DOS)	Yes	Yes	?
CP/M 86	Yes	Yes	?
MP/M 86	Yes	–	?
OASIS-16	Yes	–	?
XENIX	Soon	–	?
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RS-232 Communications	Yes	Yes	?
B/W and Color Display Controller	Yes	Yes	?
Expansion Memory	Yes	Yes	?
Z-80 CP/M-80 Board	Yes	–	?
Cache Buffer Hard Disk	Yes	–	?
Time/Calendar Board	Yes	–	?
IEEE Bus Controller	Yes	–	?
8" Floppy Disk System	Yes	–	?
8" Hard Disk System	Up to 40 Mbytes	–	?
Tape Cartridge System	Yes	–	?

[1]For comparison purposes, typical professional configurations consists of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

[2]Columbia Data Products also supports CP/M 80 with an optionally available Z-80 CP/M Expansion Board.

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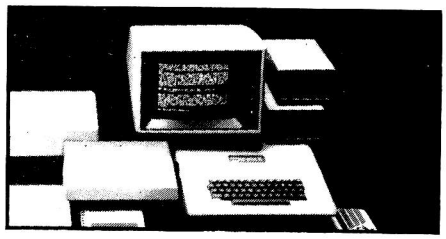
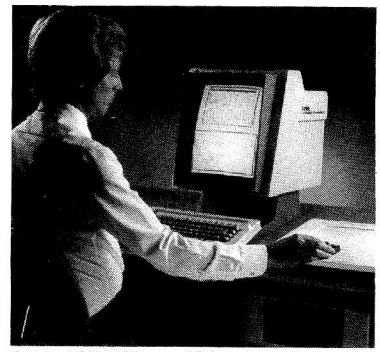
CPM 86,80		





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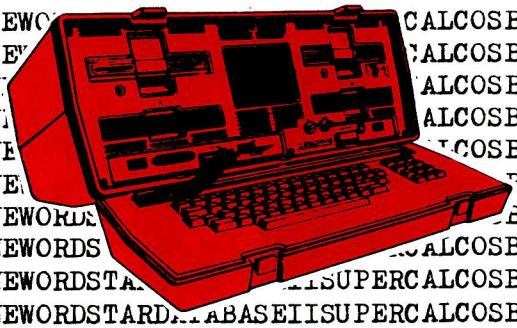

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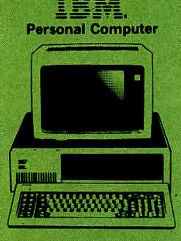

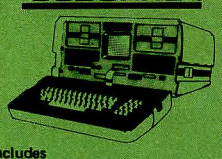

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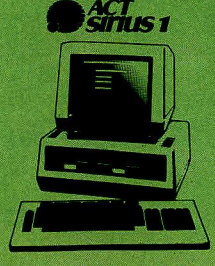

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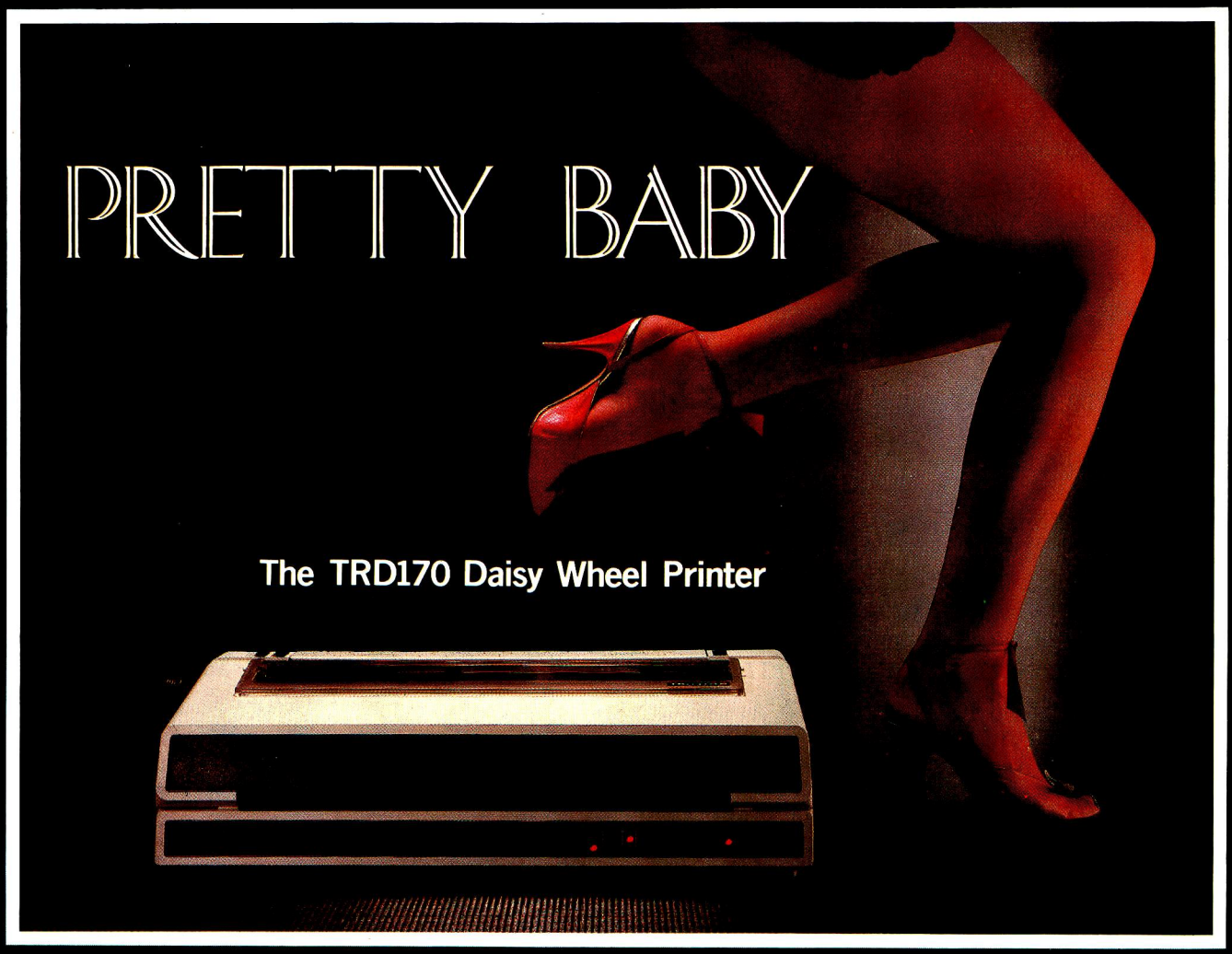

Pretty baby in appearance. But the TRD170 is a real work horse when it comes down to performance.

We believe it's just about the best value around in dedicated daisy wheel printers. In fact, the TRD170 is probably the lowest priced full-featured daisy wheel printer on the market.

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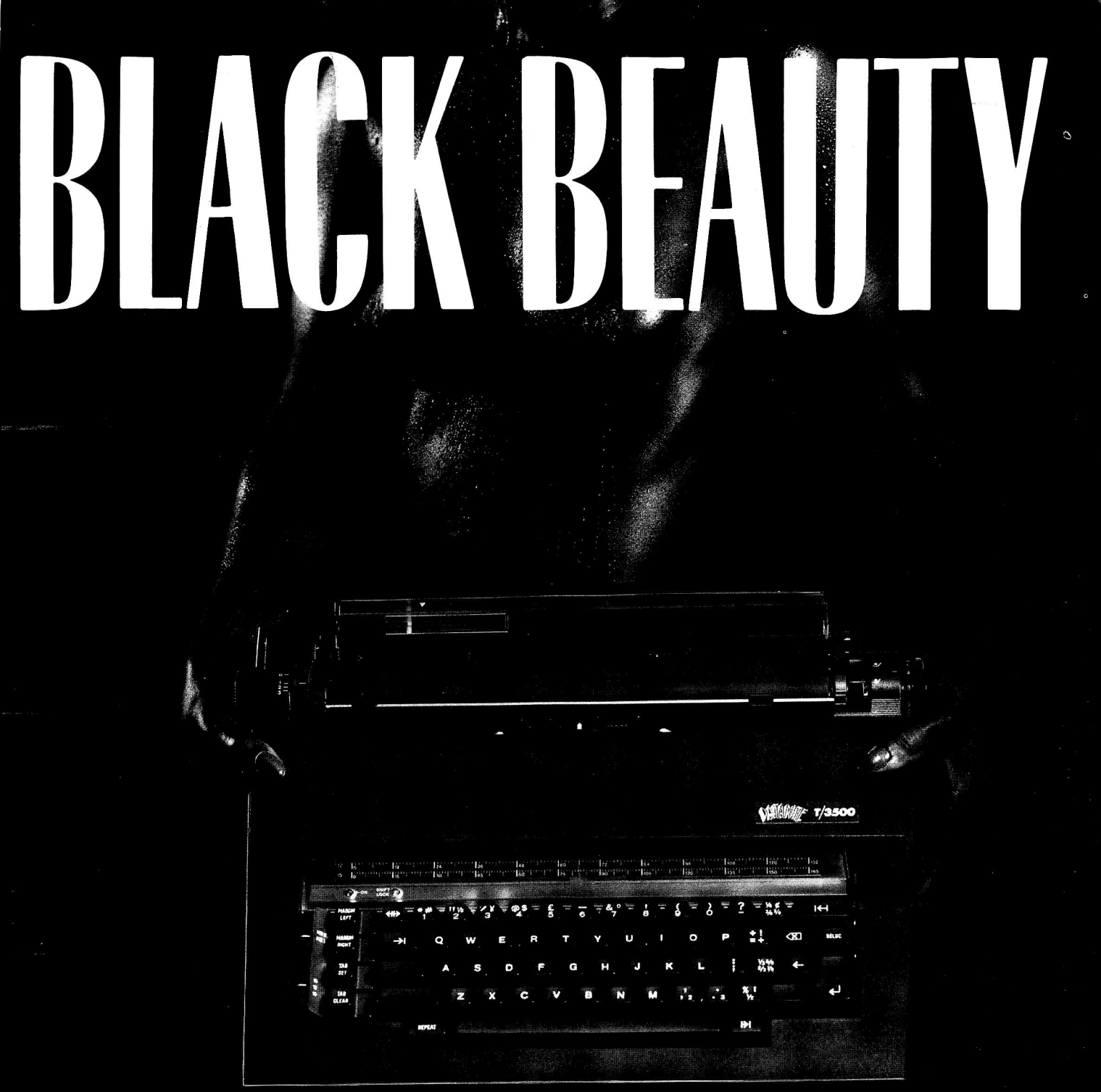

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Because when you're finished using the T/Printer 3500 as a daisy wheel printer for your computer, it's ready to go right on working as an electronic typewriter. Plus it's also a genuine full KSR terminal, able to send data as well as receive. So you get triple value for your money.

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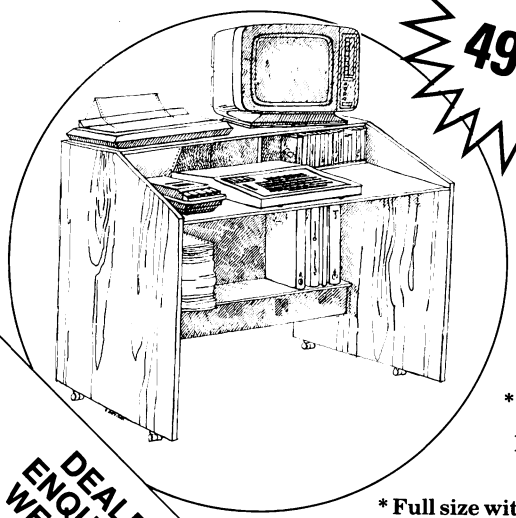

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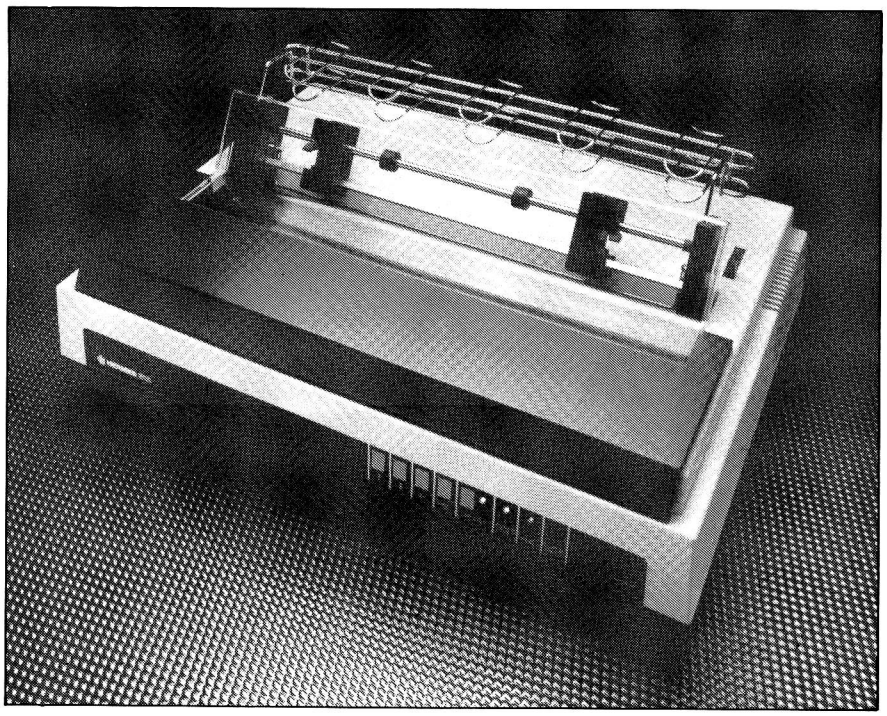

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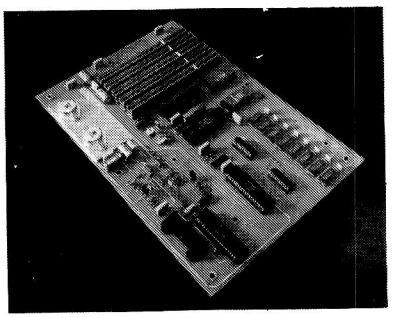

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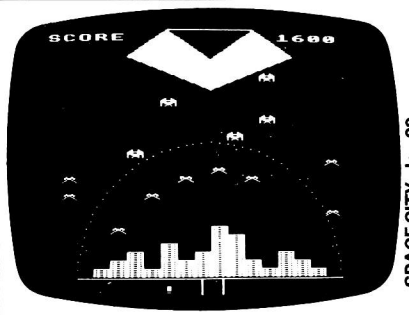

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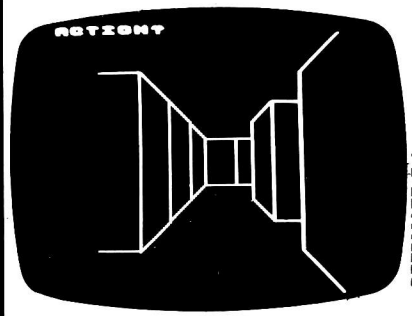

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December/January Issue: Program Features: Space City (invader-type game), Breakout, Artist (Joystick painting program); Rescue (miraculously retrieves programs after bad loading or 'Bad Program' message); and Pack – a program to compact Basic programs. PLUS Disc System Review, Software reviews – including Wordwise, Book reviews, Adding Joystick interface to model A; How to access the video controller chip; and ideas for the newcomer; plus a new crop of Hints and Tips.

February Issue: Program Features: **BEEBMAZE** – Find your way through the random maze, guided by 3D views from inside the maze – an excellent game. **FIVE-DICE** – A Beeb implementation of YAHTZEE (R), a novel dice game. Also a listing of **WINDY FIELD** – a creation from Acornsoft, **SPIROPLOT** screen doodler, and a complete memory display program in a user key. Plus **Machine Code Screen Dumps for the Epson and Seikosha Printers;** articles on **USING FILES, IDEAS ON ANIMATION** (including a Rotating Cube program) an **Introduction to the Use of Procedures, a Survey of Books on the BBC Micro,** and a Roundup of **Disc System Hints.** PLUS a variety of **HINTS, TIPS AND INFO,** including a single VDU command to perform a SIDEWAYS SCROLL. **WIN A COLOUR MONITOR, WORDWISE WORD PROCESSORS AND ACORNSOFT GRAPHICS BOOKS IN OUR THIRD SOFTWARE COMPETITION.**

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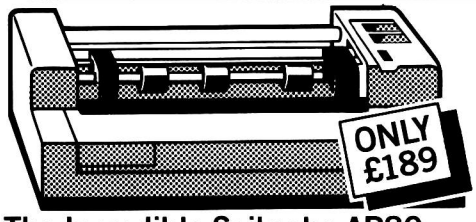

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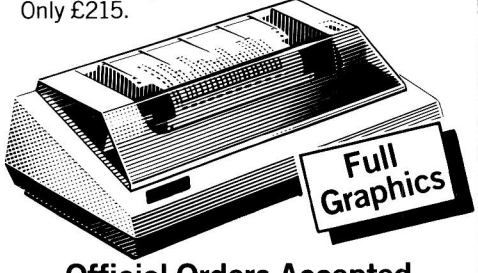

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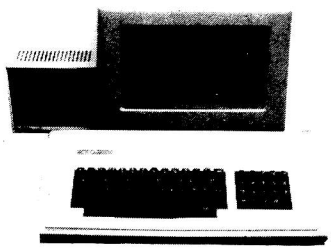

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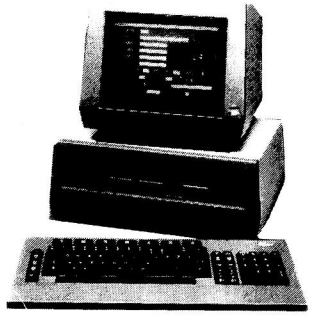

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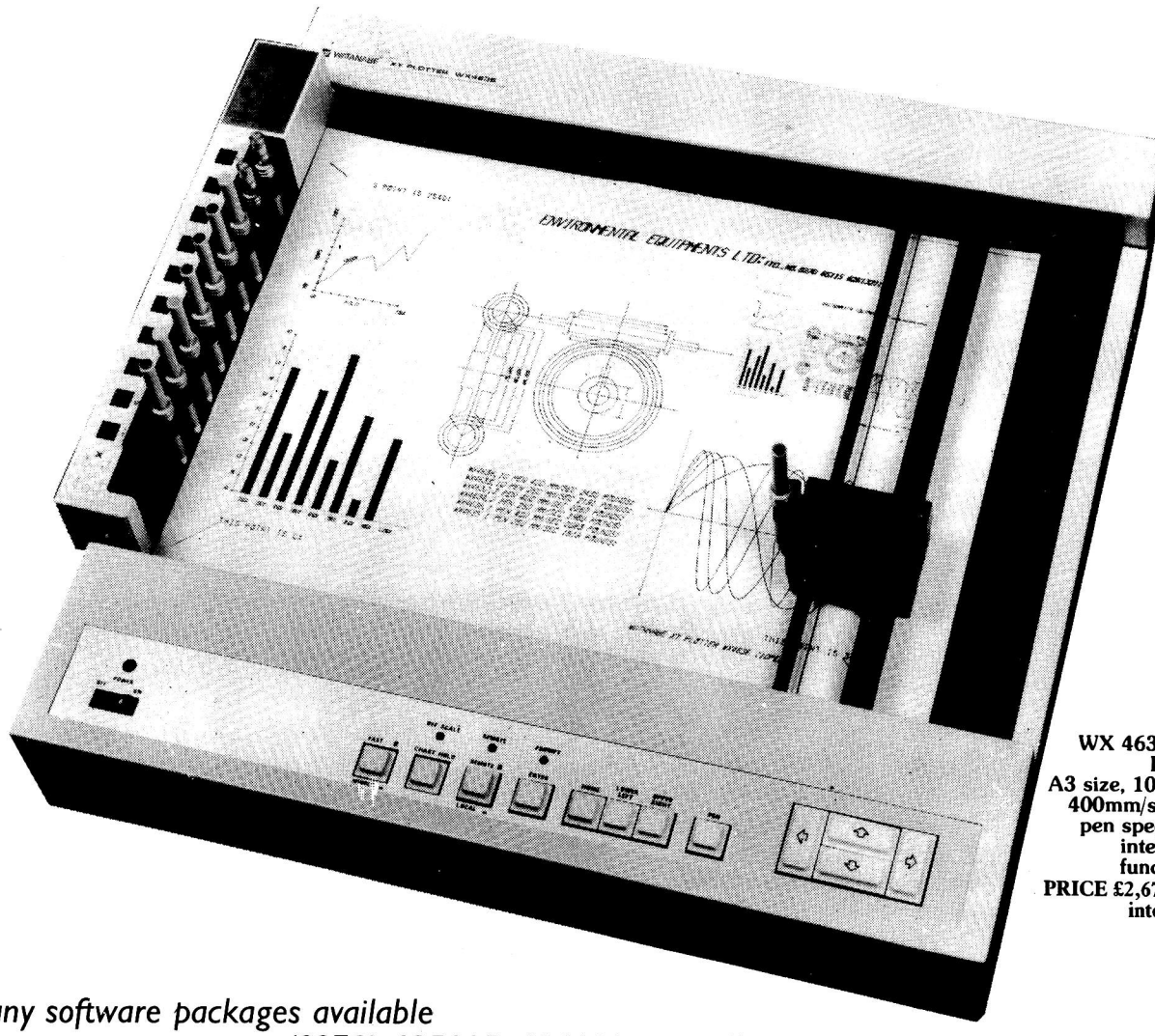

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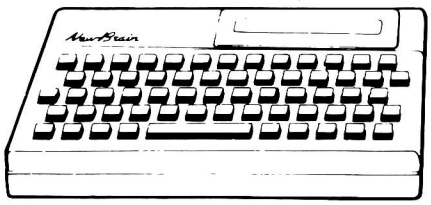

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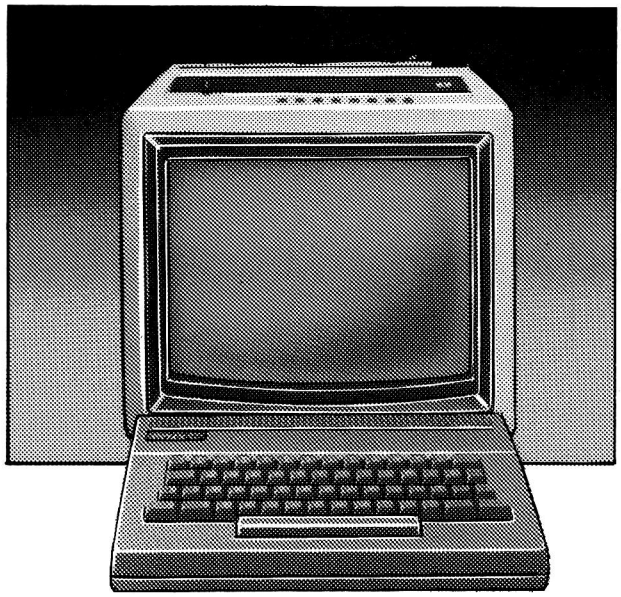

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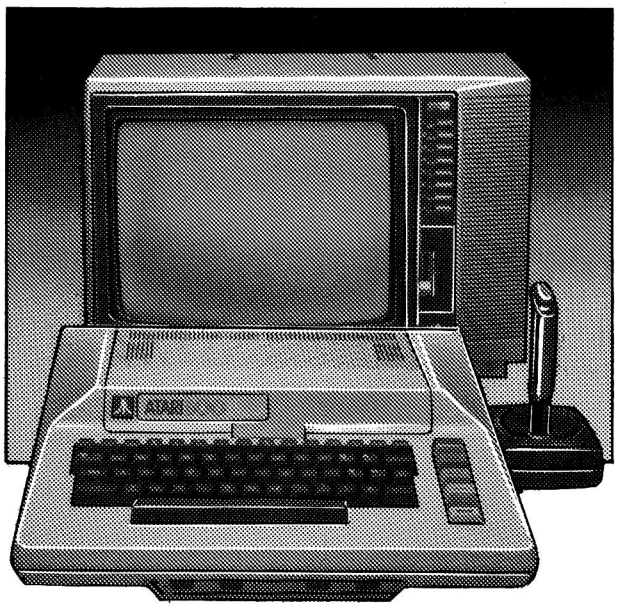

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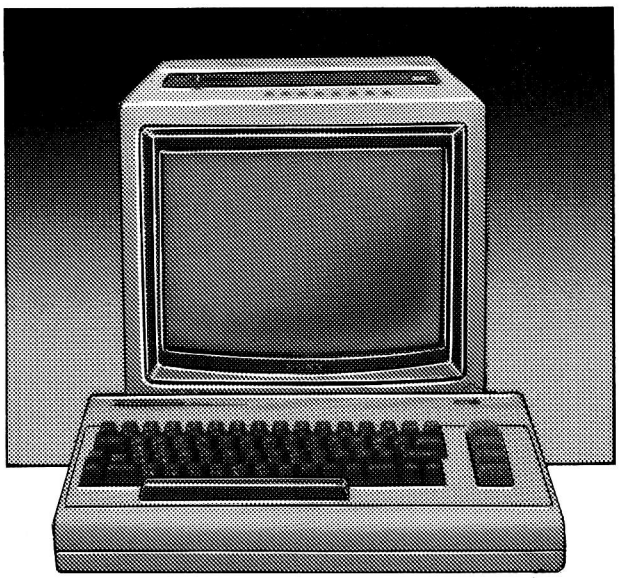

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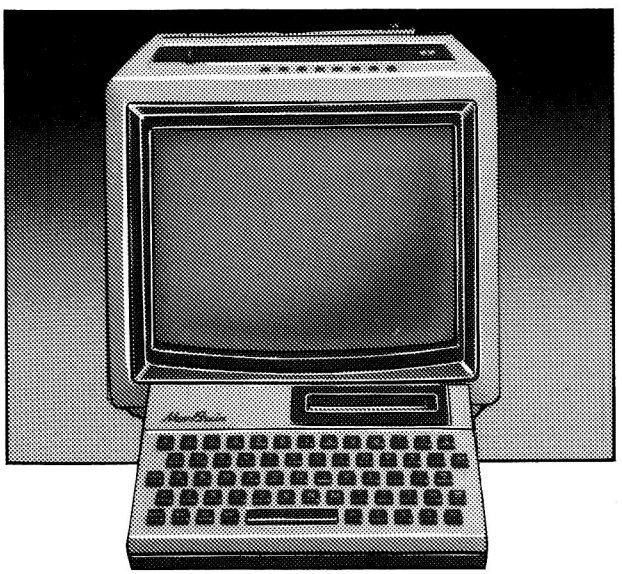

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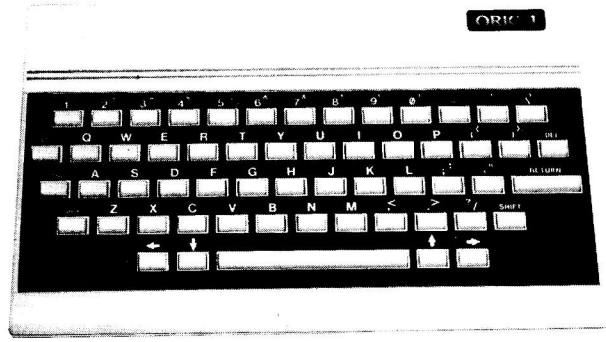

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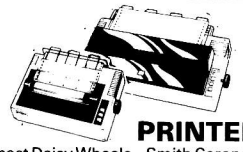

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Auto insertion of lines.
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3 Variables can be of any length. First five characters used to distinguish one variable from another. Multi-dim arrays, string arrays and integer arrays.
4 Full Tape and Disc file handling.
5 32 standard error messages and traps. Ability to trap **BREAK KEYS.** Error table is extendable.
6 Possible to run programs larger than memory capacity.
7 Special features allow transfers of programs from machine to machine.
8 **Xtal BASIC 3** is designed to be compatible with most available BASICS and a program is supplied for many BASIC to BASIC conversions.
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10 **SIZE 12K to 14K** depending on the System.
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Consider the advantages in these features: The user manual is contained in FIVE pages. All reports are generated by robot functions. Reliability tested (benchtest PCW June). Works in a network multi-user environment. Fast easy data entry. Files are re-organised and sorted automatically. Produced by the same people that originated 'BUSiness', 'DBMS II', 'DB-CALC', 'AUTOLOAD AND RECOVER', 'ETC' and sold successfully over the past five years.
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We also have a special 'spooler module' as well as software controllable port expanders and modems for output to telephones, printers, and screens so that a number of terminals may share the resources of one printer, as well as be able to send files over the telephone at any time (day/night) to both store on the hard disk and print out as well.

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Features: Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left, delete right, tab right-left-up-down'. Paint your form as you like directly on the screen.

Text: Write a letter as you see it on the screen, edit it then simply enter P to print.

Calc: Set into the form, your data fields, "£££££" and specific file-related activities, formulae and validation checks. Enter values and see the spreadsheet calculate itself.

Database: Search files for data to be inserted to fields specified. All the features of DBMS III, explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery... You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

INVOICE <0>£££££££££££

To £<1>£££££££££££
£<2>£££££££££££££
£<3>£££££££££££££
£<4>£££££££££££
£<5>£££££££££

From: G.W. Ltd
55 Bedford Court Mans.
Bedford Avenue
London W.C.1.
Tel: 01-636 8210

Date <6>££.££ Tax point <7>££.££ Agent <8>£££

Quantity	Description	Cost	Tax	Total
<9>£££	<10>£££££££££££	<11>£££	<12>££	<13>£££
<14>££	<15>£££££££££££	<16>££	<17>££	<18>£££

and so on...

Total...<19>£££££ Tax...<20>££££

<??> items <1> to <5> internal command to request name input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> item <9> request quantity, validate range.
<??> item <10> request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>.

Now comes the more valuable facility. You can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.
eg: Send fields <0>, <1>, <6>, <7>, <11>, <12>, <13>, <19>, <20> to sales ledger.

Then send fields <9>, <10>, <11> to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file.
Then send fields <10>, <11>, <12> <13> to Nominal ledger. Do you see?

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3200 records per filename. 20 main/200 sub fields per record. Field and record related formulae. 'Jump-to' any of 32000 records per file. Random/binary/key/multiple field search. 'If-then' questioning. File protection/password entry. Range match.not match.integer match. Sort speed 500 records per 20 seconds. Endless 'either-or' matching. Formulate/recall on selection criteria. 13 interrogation question types. Short filing output/audit trails. 'sale-mail- shots'; 'production-process'; 'purchase/sales-analysis'; 'personnel-file'.

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DBMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER

Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the profram to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "analysis"; "patient history analysis"; "research-analysis"; "budgetting-analysis"; "vehicle-location control"; "linrarian analysis"; "plus more?"

Previous issues showed examples of 'employees-short-list', 'garage stock, re-order', 'sales analysis', 'librarian's list', 'hospital's patient list'

Here is an example of a 'rental file' and a report it might generate.

The record may look like this:
1 – record number (413)
2 – client (Radio Cars Ltd)
3 – date of contract (01.04.81)
4 – date last pmt (12.02.82)
5 – period/frequency (36/monthly)
7 – amount of pmt (22.50)
8 – item type (Taxi-phones)
9 – repairs made (faulty microphone – item replaced)
10 – cross reference (3.442!C details of full system spec and supplier)

One report might be: select ?? all records where the amount of payments are less than 50 pounds, that were taxi-phones and faults were detected. When found, pick up the cross reference code and look up that record to identify the supplier.

DBMSII (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) AND MS-DOS (tm) ie: <SIRIUS/VICTOR/IBM> DBMSII IS 395.00 (or 250.00 by mail order ex. training). DBMSIII is 575.00 (or 295.00 by mail order ex. training).

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FD10-4008 D-Side/D Den 8 Sect	31.00	29.00	28.00		
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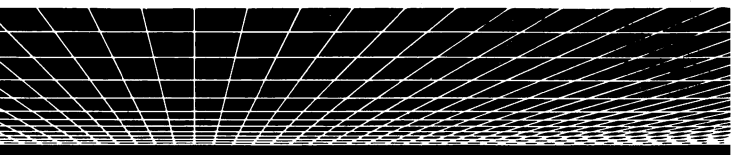

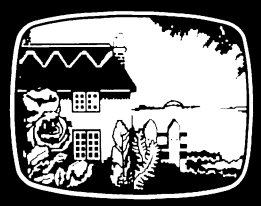

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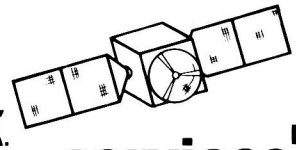

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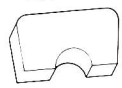

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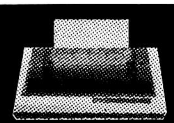

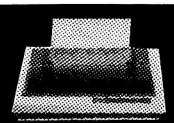

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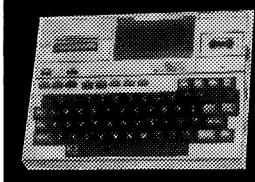

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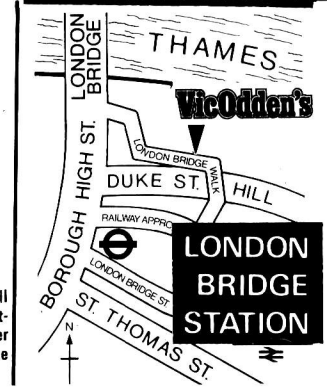

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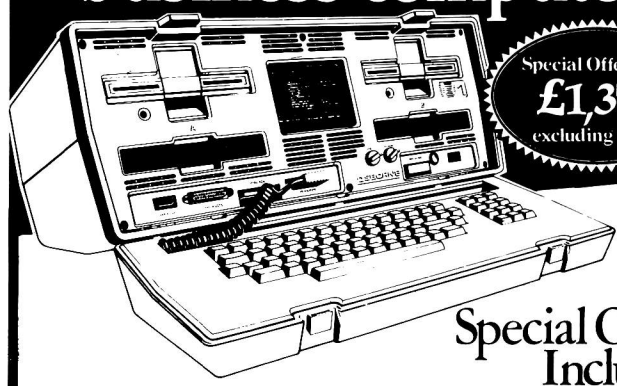

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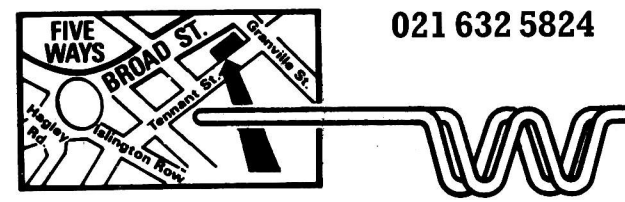

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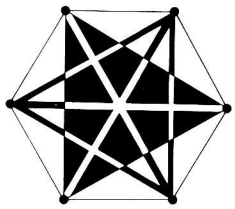

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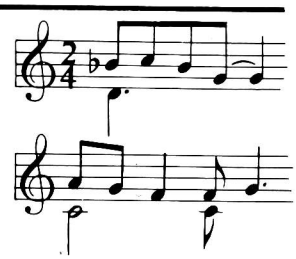

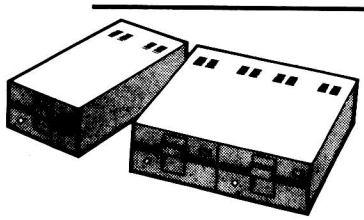

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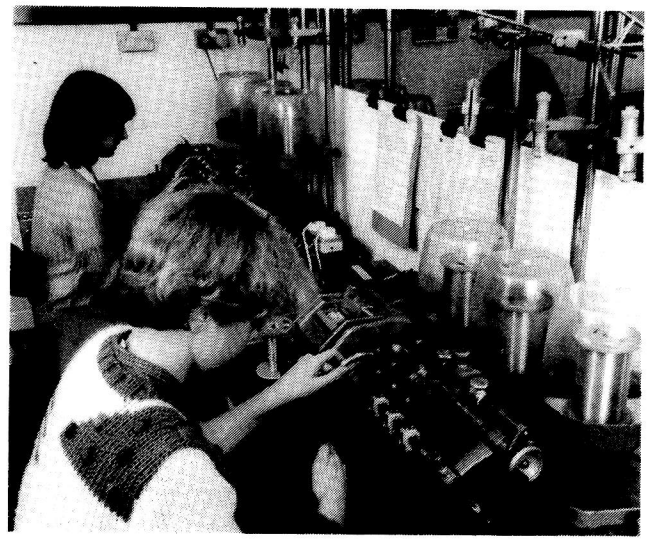

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After a deep and intense discussion on the subject, the editorial team has to make it plain that it does not have any confidence whatsoever in the accuracy of some advertising photography. This refers to screen display photos in particular. The credibility of many pictures as far as inexpert readers is concerned was badly shaken when the ZX Spectrum was launched. Its advertisement can still be seen to contain a screen photo of one of those annoying 'mexican hat' graphs. In orange. In fact, the Spectrum is incapable of producing this colour without using the user-definable characters to produce a chequered red/yellow pattern which, at a distance, could conceivably be a blotchy sort of orange — certainly not the crisp, clear colour in the photo. Similarly, then, the adverts for the Torch. These screen photos show a screen displaying an uncannily lifelike picture of the world. High resolution graphics, yeah, but this is too much. . . and there are many, many more of them, too. Why is it that we're not told which pics are simulations and which aren't? We think we should be told. . . On the other side of the coin, some chaps are being a bit more honest about themselves (or their products) — or at least USA company Mad Computer Inc is. Its micro is called the MAD1. Sooner or later you'll be buying your software from Bozo Research Ltd, your printers from Psycho Peripherals Ltd and your interfaces from Schizo Components. We're going to persuade some lunatic to benchtest the MAD1 if we can get hold of it. . . The *PCW* accolade for taking the initiative this month must go to Cheltenham Ladies' College. This noble establishment has just announced the installation of a computer system on its time-honoured premises. Not to educate the girls, though. No, it sends out the bills. Remember Screenplay's review of Spectrum game 'Hungry Horace' in January's *PCW*? Well Psion has produced a sequel to what it calls an 'interactive cartoon', called 'Horace Goes Skiing.' Many more Horace titles spring to mind. How about 'Horace Runs a Creche'? or 'Horace Starts a Magazine'? or even 'Horace Designs a Computer'? We'll award a prize of £10 — yes folks, £10! — to the reader who, in our estimable opinion, writes in with the most imaginative/humorous/topical Horace title before 21 April. We'll probably publish some of the funny ones, too. So pencils and paper at the ready! Send your entry to: Horace Jokes, Personal Computer World, 62 Oxford Street, London W1A 2HG. Don't forget that the editors' judgement is final. . .

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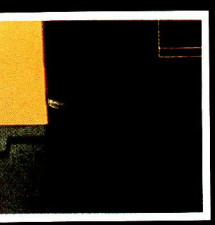

fig. 1

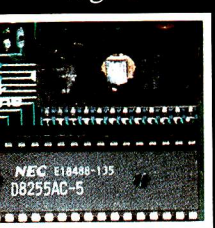

fig. 2

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WHAT DOES THE X-ROM CARD OFFER?

1. **The X-ROM CARD has a built in autostart ROM.** Programs can be run automatically every time the ZX 81 is switched on. This will result in a huge increase factor for **ROM based software**, since all software houses are currently very aware of copyright piracy problems.
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3. **The X-ROM CARD has a built in EPROM burner.** This means that you can save Basic or Machine code programs onto silicon chips and play them back at any time.
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  - **Power requirement:** Use exclusively Sinclair PSU.
- X-ROMCARD:
  - **Autostart ROM:** 4K byte, exchange for 8K bytes and software switch possible. Displays memory size, checks for byte "00" (identifies ZX basic) @ 2000H. Loads program if found, checks for byte "C3" and jumps (2000H) if found. Checks for presence of ROM in socket n.3 and ROM catalog, displays catalog if found. Contains also machine code monitor and printer utility.
  - **Preprogrammed ROM:** Catalog available on request. Use only 2732 or 2764 ROM/EPROM.
  - **Blank EPROM:** Use only 2764 — 8K bytes per device — in socket n.3. 3 × 9V, PP3 size batteries are needed to burn EPROM.
  - **Printer connection:** 16 pin DIL output, use standard IDC ribbon cable. Outputs include DO to D7, Strobe, Reset, Inputs include No-fault and Busy.
  - **Documentation:** Schematic diagram included, full listings of Autostart ROM extra (only for X-ROMCARD user, £1.50 + large SAE)

AUDIO-COMPUTERS

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SPECIAL RAMPACK 16K		£19.95	
X-ROMCARD		£14.95	
Preprogrammed ROM CATALOG		free	
BLANK EPROM 2764		£ 9.95	
Postage and packing		£ 1.00	£ 1.00

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